Henry S. Tobin

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# TREATISE

ON

# MILITARY CARRIAGES

AND

# OTHER MANUFACTURES

OF THE

# ROYAL CARRIAGE DEPARTMENT.

*FOURTH EDITION.*

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# PART I.—FIELD.

## SECTION I.—WHEELS AND AXLETREES.

### CHAPTER I.—CLASSIFICATION AND CONSTRUCTION.

Wheels are classified according to the axletree arms on which they will run.

There are two distinct varieties of axletree arms in the service.

The first, commonly known as "the old pattern arm," was used with all field and transport carriages previously to 1868.

The second, or "new pattern" arm, was approved in 1868, and has, since that date, been generally introduced for new carriages.

The axletrees belonging to each pattern are divided into three classes, namely: first, second and third, according to the dimensions of their arms. All arms of the same class and pattern are similar in dimensions, and suitable for all wheels of corresponding class and pattern. With a few exceptions, first class axletrees are used generally for siege gun carriages; second class for field artillery carriages; and third class for transport wagons and carts. There are also certain axletrees the arms of which do not agree in dimensions with those of any of the above classes, and which are therefore classed under the head of "special."

Axletrees for naval travelling carriages are classed under the head of "naval," whether their arms agree in dimensions with one of the first three classes or not.

In order to clearly distinguish the wheels and axletrees, which are respectively suitable to each other, it has been approved to add a letter, denoting the pattern, to the nomenclature of certain wheels and axletrees. The letter A is added to the nomenclature of old pattern wheels, and axletrees with old pattern arms, belonging to each of the first three classes. The letter B is similarly added to new pattern wheels, and axletrees with N.P. arms, belonging to each of the first three classes. Wheels and axletrees, which are special, and those for naval service do not receive a designating letter.

The arms belonging to each pattern and class are shown in Plates I. and II. They are all conical in form, the slope of the cone varying with each class, but for the same class the cone is the same for both A and B pattern. The point of the arm is rounded off. The arm is given a small inclination downwards, termed the *hollow*, and an inclination forwards, termed the *lead*. The hollow and lead together constitute the *set* of the arm.

In the first class the A pattern arm, Fig. 1, Plate I, is longer than the B pattern, Fig 2, and the latter is slightly rounded off at the shoulder.

In the second class the A pattern arm, Fig. 1, Plate II, is longer

than the B pattern, Fig. 2, Plate II. In this class the B pattern arm is formed with a cylindrical collar at the shoulder, with the exception of the axletree arm of the 13-pr. R.M.L., Fig. 3, Plate II*, The axletree arm of the 12-pr. B.L., Fig. 4, Plate II, is intermediate in length between the A and B patterns, and is designated in the vocabulary under the letter C. The second class arm of the B pattern can be converted to C pattern by removing the cylindrical collar at the shoulder.

In the third class, Figs. 3 and 4, Plate I, the lengths of both A and B patterns are practically the same; the B pattern arm has, however, the cylindrical collar at the shoulder, as in the second class, and is rounded off at the base of the cone.

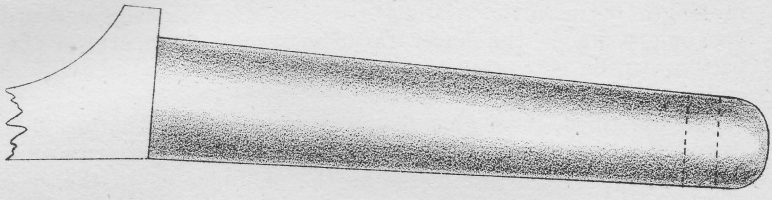
Both axletrees and wheels have been arranged for purposes of nomenclature in a numbered series. (Transporting axletrees are not included.)

The following table gives the axletrees in the service and the wheels for which they are respectively intended;—

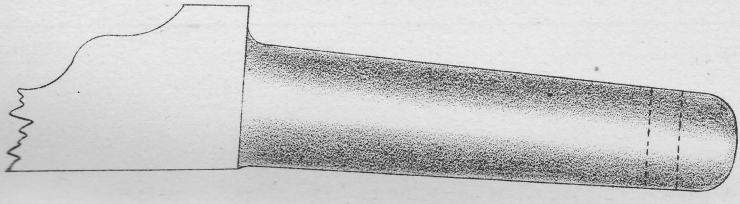
| Designation. | Detail. | Wheel No. |
|---|---|---|
| Pattern A | | |
| 1st Class | 1st class A wheels, 16″ pipes | |
| No. 1 | 1st class A wheels, 16″ pipes, carriages wood siege R.B.L. 40-pr. R.M.L. 64-pr. and S.B. .. .. .. .. .. | 1 |
| 101 | Cart sling .. .. .. .. .. | 102 |
| 102 | Wagon sling, 6 tons .. .. .. .. | 101 |
| 2nd Class | 2nd class A wheels, 13 in. pipes | |
| No. 14 | Carriage, field, R.B.L. 20-pr. to 9-pr.* S.B. 24-pr.*howitzer, 12-pr.* gun and howitzer† 9-pr.* and 6-pr.† carriage limbers R.B.L. 20-pr.* 12-pr.† and 9-pr.† S.B., 12-pr.* gun, 24-pr. howitzer,† to 6-pr.wood ammunition wagons† and limbers (except R.B.L. 6-pr.) limber,* wood siege and wagon,‡ platform hind. | 13¼ 14* 15† |
| 15 | Carriages and limbers, mortar, 10 and 8 in.. | 16 |
| 16 | Limbers, iron platforms .. .. .. | 18 |
| 17 | Wagon platform, fore.. .. .. .. | 17 |
| 111 | Carriage, spider .. .. .. .. | 113 |
| 112 | „ timber, 10-ft. wheel.. .. .. | 112 |
| 113 | „ „ 6-ft. wheel and devil .. | 113 |
| 114 | „ „ medium .. .. .. | 15 |
| 115 | Cart, coal, Gibraltar, large, and shot.. .. | 15 |
| 116 | Cart, fatigue .. .. .. .. .. | 15 |

* For future manufacture the axletree arms of the Imperial field artillery equipment will be formed without a collar at the shoulder, so as to make them uniform with those of the Indian pattern, in order to ensure interchangability of the wheels. § 5013.

## 1ST CLASS.

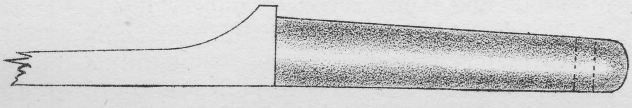


A PATTERN. *Fig. 1.*

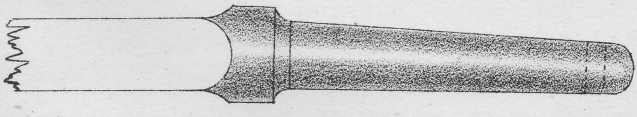


B PATTERN. *Fig. 2.*

## 3RD CLASS.



A PATTERN. *Fig. 3.*



B PATTERN. *Fig. 4.*

DANGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN 12462.

| Designation. | Detail. | Wheel No. |
|---|---|---|
| No. 117 | Cart, Gibraltar, small . .. .. .. | 114 |
| 118 | Cart, trench .. .. .. .. .. | 16 |
| 119 | Cart watering* box, and *equirotal siege*† *wagon* .. . .. .. .. | 14*<br>16† |
| 120 | Limbers, sling, 12* and 6† tons .. .. | 14†<br>17* |
| 121 | Wagon deal, fore .. .. .. .. | 16 |
| 122 | *Wagon, Flanders, fore*.. .. .. .. | 16<br>115 |
| 123 | Wagon, *Flanders*,* and deal,† hind .. .. | 15*<br>16† |
| 3rd Class A | 3rd class A wheels, 8·87-in. pipes | |
| No. 45 | Carriages, field, limbers, and ammunition wagons R.B.L. 6-pr. service and S.B. 3-pr. | 44 |
| 46 | Carriage, field, limber, and ammunition wagons R.B.L. 6-pr.* special, carts, forge,† (O.P.) Maltese (Marks I and II‡) R.E. tip‡ (O.P.), water‡ (Mark I) and wagon, ambulance equirotal† | 43*<br>44†<br>162‡ |
| 147 | Cart brake, chaise, or market.. .. .. | 137 |
| | Cart forge* (O.P.), Maltese (Marks I and I†) R.E.† tip (O.P.), water† (Mark I) and equirotal* ambulance wagon .. .. .. | 44*<br>162‡ |
| 148 | Cart, hand, common, and timber-carriage small .. .. .. .. .. | 44 |
| 149 | Cart, hand watering .. .. .. .. | 44 |
| 150 | „ projectile .. .. .. .. | 138 |
| 151 | Wagon, equirotal, forge and G.S. .. .. | 44 |
| Pattern B. 1st Class | 1st class B wheels, 12-in. pipes | |
| No. 5 | Carriage, siege, R.B.L. 40-pr. 6 ft. parapet .. | 7 |
| 6 | „ „ R.M.L. 6·6″ gun .. .. | 5 |
| 7 | Carriages, siege, R.M.L. 8″ 70 cwt., 6·6″ or 6 3″ howitzer, 64 and 40-pr. .. .. | 6 |
| 8 | Carriage, siege, R.M.L. 8″ 46 cwt. howitzer .. | 6 |
| 107 | Wagon, sling, 7 tons .. .. .. .. | 107 |
| (1)2nd Class | 2nd class B wheels, 10″ pipes | |
| 23 | „ „ R.M.L. 25-pr. .. .. | 24 |
| 24 | „ „ „ 16-pr. (Mark I).. | 25 |
| 25 | „ „ „ 16-pr. (Mark II) | |
| 26 | Steel carriage field limber and ammunition wagon, R.M.L. 13-pr. .. .. .. | 26 |

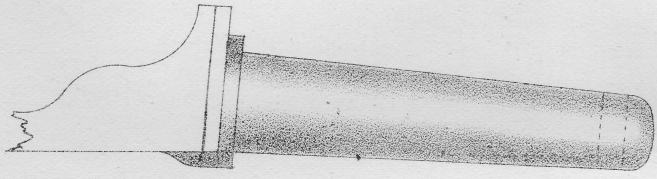
(1) Nos. 28 and 30 are alike in shape and size, but are drilled differently, Nos. 27 and 28 are alike with the exception that the ends are shaped to different depths.

Nos. 25 and 31 are alike in shape and size, but are drilled differently, while Nos. 24 and 25 are alike except that ends are shaped to different depths.

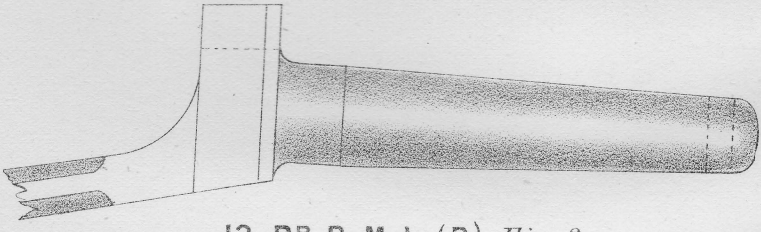
# 2ND CLASS.



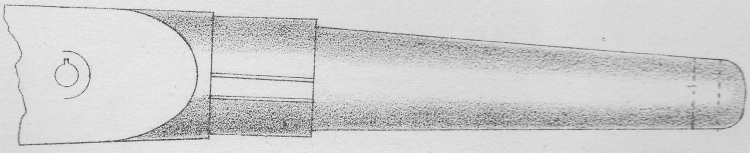
A PATTERN. *Fig. 1.*



B PATTERN. *Fig. 2.*



13 PR R.M.L.(B) *Fig. 3.*



C PATTERN. *Fig. 4.*

DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12452.

| Designation. | Detail. | Wheel No. |
|---|---|---|
| No. 27 | Carriage field R.M.L. 9-pr. (Mark I) .. | 24 |
| 28 | „ „ „ 9-pr. (Mark II) .. | 25<br>27 |
| 29 | Limbers, field, and ammunition wagons R.M.L. 25,* 16,* or 9-pr.*‡ (Mark I) limber and ammunition wagon R.M.L. 40-pr. (Mark I*) and forge limber and wagon (Mark I*†) .. .. .. .. | 24*†<br>25*† |
| 30 | Limbers, field, R.M.L. 25*, 16*, or 9-pr.*† (Mark II), forge (Mark II*), store* and ammunition wagon limber, R.M.L. 40-pr.* (Mark II) .. .. .. .. .. | 27*† |
| 31 | Limber, siege, iron .. .. .. .. | 24<br>25 |
| 32 | Wagons, ammunition, R.M.L. 40-pr.* 25*, 16*, or 9-pr.*† (Mark II), forge (Mark II) and store* .. .. .. .. .. | 24*<br>25*<br>27† |
| 33 | Wagon, R.A. ammunition and store, fore .. | 28<br>29<br>38 |
| 34 | „ „ „ hind .. | 24<br>25<br>27<br>37 |
| 3rd Class | Coned at shoulders, 3rd class B wheels, 8·87″ pipes | |
| No. 52 | Carriage, field, Gatling 0·45″.. .. .. | 50 |
| 53 | Carriage, field, R.M.L. 7-pr. (Colonial) .. | 49 |
| 54 | Limber, field, Gatling 0·45″ .. .. .. | 50 |
| 55 | Limber, field and ammunition wagon R.M.L. 7-pr. (Colonial) .. .. .. .. | 49 |
| 156 | Cart, ambulance .. .. .. .. | 156 |
| 157 | „ forge, Maltese*‡ (Mark III and IV), water (Mark II* and III†), and forage*‡ | 144*<br>145†<br>162‡ |
| 158 | Cart, G.S. and R.E. tip† .. .. .. | 144†<br>147*<br>162†<br>163* |
| 159 | Cart, transport spring.. .. .. .. | 147 |
| 160 | Cart, water (Mark IV curved body).. .. | 145 |
| 161 | Wagon, Ambulance (Mark III†), converted light* supply, and pharmacy† fore .. | 152†<br>153* |
| 162 | Wagon, Ambulance (Mark III†), converted light* supply, and pharmacy,† hind .. | 148†<br>149* |
| 163 | Wagon, forge, lock under,*†G.S. (Mark III*†) and powder,† fore .. .. .. .. | 151*<br>164† |
| 164 | Wagon forge, lock under*† G.S. (Mark III*†) and powder,* hind .. .. .. .. | 147*<br>163† |

| Designation. | Detail. | Wheel No. |
|---|---|---|
| No. 165 | Wagon G.S. (Mark IV*§) hospital,*§ surgery,† and R.E.‡ (except pontoon and timber) fore | 150‡<br>151*<br>152†<br>164§ |
| 166 | Wagon G.S. (Mark IV*§), hospital*§, surgery,† and R.E.‡‖ (except pontoon and timber) hind .. .. .. .. | 145‡<br>146‖<br>147*<br>148†<br>163§ |
| 167 | Wagon, pontoon, fore.. .. .. .. | 150 |
| 168 | „ „ hind .. .. .. | 145 |
| 169 | Wagon, ambulance (Mark IV), fore.. .. | 154 |
| 170 | „ „ „ hind .. | 148 |
| 171 | „ transport, „ fore.. .. | 155 |
| 172 | „ „ „ hind .. | 147 |
| Pattern C 2nd Class | For wheels with 11″ pipes | |
| No. 37 | Carriage 12-pr. B.L. .. .. .. .. | 36 |
| 38 | Limber and wagon, 12-pr. B.L. .. .. | 36 |
| 39 | Wagon, artillery, fore.. .. .. .. | 37 |
| 40 | „ „ hind .. .. .. | 38 |
| Special | | |
| No. 76 | Carriage, field, S.B. 4⅖″ howitzer .. .. | 58 |
| 77 | „ mountain, R.M.L. 2·5″ .. .. | 67 |
| 78 | „ „ „ 7-pr. 200 lbs. .. | 58 |
| 79 | „ „ „ 7-pr. 150 lbs. .. | 68 |
| 80 | „ steel R.M.L. 7-pr. 150 lbs. (Gold Coast) .. .. .. .. .. | 75 |
| 81 | Carriage, wood, R.M.L. 7-pr. 150 lbs. (Gold Coast .. .. .. .. .. | 75 |
| 82 | Limber, field, S.B. 4⅖″ howitzer .. .. | 58 |
| 83 | „ mountain, R.M.L. 7-pr. 200 lbs. .. | 58 |
| 84 | „ wood, traversing platform .. .. | 78 |
| 85 | Barrow, China pattern .. .. .. | 74 |
| 86 | „ powder .. .. .. .. | 76 |
| 179 | Drug, 25 ton gun, fore .. .. .. | |
| 180 | „ „ „ hind .. .. .. | 170 |
| 181 | „ 5 ton „ and large, fore .. .. | |
| 182 | „ „ „ „ hind .. .. | |
| 183 | „ medium, fore .. .. .. .. | |
| 184 | „ „ hind .. .. .. .. | |
| 185 | „ small or West India, fore .. .. | |
| 186 | „ „ „ „ hind .. .. | |
| 187 | Truck, flat top.. .. .. .. .. | 78 |
| Naval | | |
| No. 61 | Carriage, Gardner, 0·45″ .. .. .. | 57 |
| 62 | „ Gatling, 0·65″ .. .. .. | 57 |
| 63 | „ „ 0·45″ .. .. .. | 57 |

| Designation. | Detail. | Wheel. No. |
|---|---|---|
| 64 | Carriage, steel, R.M.L. 9-pr. .. .. .. | 56 |
| 65 | „ and limber, wood, R.M.L. 9-pr. .. | 63 |
| 66 | „ R.M.L. 7-pr. .. .. .. | 58 |
| 67 | Limber, Gardner and Gatling, 0·45″ .. | 57 |
| 68 | „ iron, R.M.L. 9-pr. .. .. .. | 56 |
| 69 | „ R.M.L. 7-pr. .. .. .. .. | 58 |

Wheels are designated by the latters A, B or C, and are divided into first, second and third classes, special and naval, in a corresponding manner to axletrees.

Any wheel, whatever may be the material of its nave, or its diameter, belonging to one of the first three classes, and designated by a letter denoting a particular pattern, will run upon any arm belonging to the same class and designated by the same letter.

The following table gives the wheels in the service belonging to pattern A.

TABLE OF WHEELS.

| Designation. | Diameter. | Width of Tire. | Weight. |
|---|---|---|---|
| A Pattern Wood Naves. | | | |
| *1st Class*— | ft. in. | in. | cwts. qrs. lbs. |
| No. 1. 40-pr. R.B.L. carriage .. .. | 5 0 | 6 | 4 2 0 |
| No. 101. Sling wagon, wood .. .. .. | 7 0 | 6 | 6 2 12 |
| No. 102. Sling cart .. .. .. .. | 5 6 | 6 | 4 3 0 |
| *2nd Class*— | | | |
| No. 13. Platform wagon, hind .. .. | 5 0 | 4 | 3 0 0 |
| No. 14. Field, heavy, carriage and limber, 20-pr. R.B.L., limber wood siege and limber sling wagon, wood .. .. .. | 5 0 | 3 | 2 1 12 |
| No. 15. Field, light, carriage, and limbers, 12-pr. and 9-pr. R.B.L., ammunition wagon 40-pr. to 9-pr. R.B.L., Flanders wagon, hind, carts, coal, fatigue and Gibraltar large .. .. .. .. | 5 0 | 3 | 2 0 7 |
| No. 16. Carriage and limber, 10″ and 8″ mortars, trench cart and Flanders wagon, fore .. .. .. .. .. .. | 4 2 | 3 | 1 2 26 |
| No. 17. Platform wagon, fore, duck cart .. | 4 0 | 4 | 2 0 9 |
| No. 18. Limber for iron platforms .. .. | 3 0 | 4 | 1 2 14 |
| No. 112. Timber carriage .. .. .. | 10 0 | 4 | — |
| No. 113. „ .. .. .. | 6 0 | 3 | 2 3 24 |
| No. 114. Gibraltar cart, small .. .. | 4 8 | 3 | 1 3 23 |
| No. 115. Flanders wagon, lock under fore .. | 3 6 | 2½ | 1 1 0 |
| *3rd Class*— | | | |
| No. 43. Carriage, limber and ammunition wagon, 6-pr. R.B.L., special .. .. | 5 0 | 3 | 1 2 5 |
| No. 44. Carriage, limber and ammunition wagon, 6-pr. R.B.L., service, hand cart, and equirotal ambulance wagon .. .. | 4 2 | 3 | 1 1 0 |
| No. 137. Carts, chaise or market .. .. | 5 0 | 2 | 1 0 17 |
| No. 138. Projectile cart .. .. .. | 4 2 | 5 | 1 2 22 |

The following description of No. 15 wheel will illustrate the construction of all wheels of the above pattern.

Construction of No. 15 wheel.

The nave consists of a stock of elm A, Plate III, containing a cast-iron pipe box B, concentric with its longer axis. The stock is cut transversely and has a hoop of wrought iron shrunk over each end and secured by three stubs. Mortises for the spokes are cut in the stock at an angle to its axis in order to give the spokes a certain inclination outwards, termed the "dish." The pipe box is conical in shape, 13″ long; its interior is enlarged towards the middle to form a grease chamber, and its bearing parts are chilled to render them sufficiently hard. The box is prevented from turning independently of the stock by two feathers cast upon its exterior at the larger end, and is secured by oak wedges driven into each end of the stock round it. When in position the pipe box should be truly concentric with the ring of the wheel, and the wedges afford the means of bringing it so.

The spokes C, twelve in number, are of oak, as already mentioned; that part of the spoke which enters the nave is termed the "foot," that which enters the felloe the "tongue." The outer edge or "face" of the spoke is straight, the inner or "back" is not; the tongue is set at an angle to the face, in order that it may pass through the centre of the felloe, and is split to take an oak wedge which is driven into it when the felloe is placed, in order to keep the latter tight down upon the shoulder until the tire is on.

The felloes D, six in number, of ash, are cut with the grain and bevelled off on the convex side; they are struck out with a greater radius than that of the wheel in the proportion of 1′ 0¼″ to 1′ 0″ and are connected by oak dowels, *d*. The convex surface of a felloe is termed the "sole," the concave the "bosom," the outer side the "face," and the inner the "back." Wheels shod with a streak tire have a rivet through each end of every felloe, to prevent the latter splitting, from the number of bolt holes which that kind of tire necessitates in it.

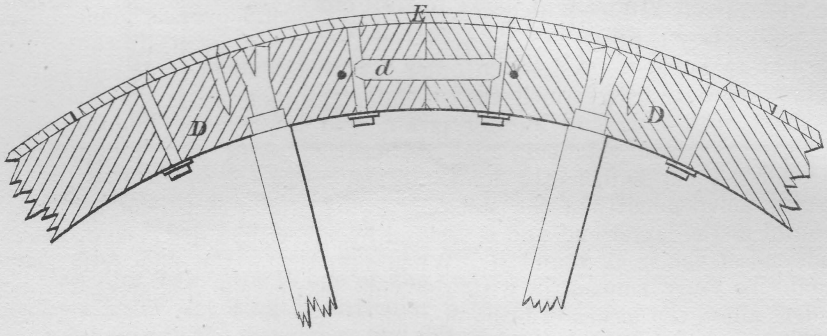
The tire E is of wrought iron ⅝″ thick; until 1868 it was made in six pieces or "streaks;" in that year the "streak" was superseded by the "ring" tire, which is simply a hoop of varying diameter to suit the bevel of the felloes, shrunk on and secured by a bolt through the centre of each of the latter; a burr is placed under the nut of each tire bolt.

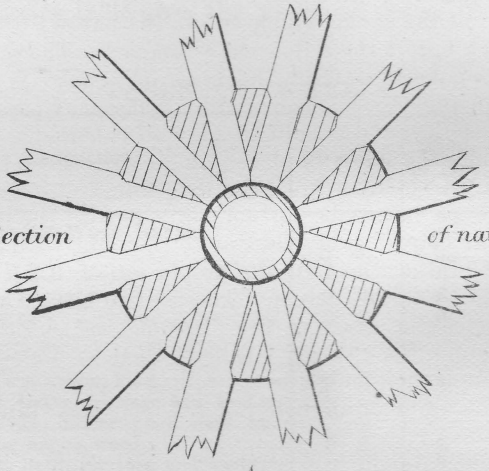
The date of manufacture is stamped on the nave; also the letters Lt. (light); the wheel receives three coats of lead colour paint.

No. 14 wheel differs from the above in being of slightly stronger make, but has the same diameter and width of tire.

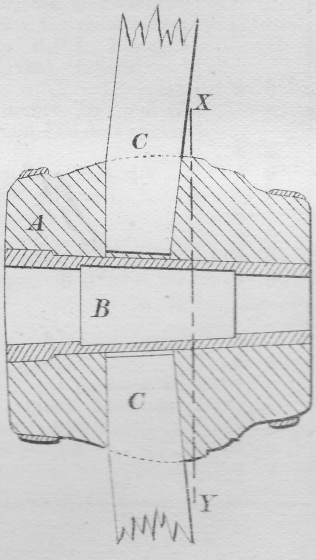
The following table gives the wheels in the service belonging to patterns B and C:—

Scale 1½"=1'



Section of nave on X.Y.




12451

Dangerfield Lith 22. Bedford St Covent Garden.

## TABLE OF WHEELS.

| Designation. | Diameter. | Width of Tire. | Weight. |
|---|---|---|---|
| B Pattern. | ft. in. | in. | cwts. qrs. lbs. |
| 1st Class. | | | |
| *Metal Naves.* | | | |
| No. 5. H.P. carriage.. .. .. .. | 6 0 | 6 | 6 3 0 |
| No. 6. Siege carriage 8″ 70 cwt. and 46 cwt. 6·6″ and 6·3″ R.M.L. howitzers, 40-pr. R.M.L. and transporting howitzer beds.. | 5 0 | 6 | 5 1 0 |
| *Iron Naves.* | | | |
| No. 7. 40-pr. R.B.L., 6 feet parapet .. | 5 0 | 4 | 3 0 15 |
| No. 107. Iron sling wagon .. .. .. | 7 0 | 6 | 6 3 22 |
| 2nd Class. | | | |
| *Metal Naves.* | | | |
| No. 24. 16-pr. R.M.L. (field, heavy, Mark II) .. .. .. .. .. .. | 5 0 | 3 | 2 0 26 |
| No. 25. (Field, Mark III) carriage 9, 16, and 25-pr. R.M.L., limber 9, 16, and 25-pr., and iron siege ammunition wagon 40-pr. to 16-pr., and 9-pr. forge and store wagon, and R.A. wagon, ammunition and store, hind .. .. .. .. | 5 0 | 3 | 2 1 2 |
| No. 26. 13-pr... .. .. .. .. | 5 0 | 3 | 2 0 11 |
| No. 27. (Field, light, Mark II), 9-pr. R.M.L. forge and store wagon and R.A. ammunition and store wagon, hind .. | 5 0 | 2½ | 2 0 6 |
| No. 28. Wagon, R.A. ammunition and store, fore.. .. .. .. .. .. | 3 4 | 3 | 1 2 6 |
| No. 29. Wagon, R.A. ammunition and store, fore.. .. .. .. .. .. | 3 4 | 2½ | 1 1 2 |
| *Wood Naves.* | | | |
| No. 32. Wagon, R.A. ammunition, and store, hind .. .. .. .. .. | 5 0 | 2½ | 1 3 8 |
| No. 33. Wagon. R.A. ammunition and store, fore.. .. .. .. .. .. | 3 4 | 2½ | 1 1 2 |
| No. 130. Timber wagon, R.E., hind .. | 4 8 | 4 | 2 1 27 |
| No. 131. Timber wagon, R.E., fore.. .. | 3 4 | 4 | 1 3 3 |
| *Iron Naves.* | | | |
| No. 121. Iron sling wagon, limber .. .. | 5 0 | 3 | 2 1 0 |
| No. 122. S.A. ammunition cart .. .. | 5 0 | 2½ | 1 2 4 |
| No. 123. Wagon, bakery, bread and meat, heavy spring, hind.. .. .. .. | 5 0 | 2½ | 1 3 26 |
| No. 124. Wagon, bakery, bread and meat, heavy spring, fore .. .. .. | 3 6 | 2½ | 1 2 3 |
| 3rd Class. | | | |
| *Metal Naves.* | | | |
| No. 49. 7-pr. colonial .. .. .. | 5 0 | 3 | 1 3 4 |
| No. 50. Gatling ·45″ field .. .. .. | 4 8 | 2 | 1 1 7 |
| No. 51. Barrow, projectile, shingle.. .. | 4 8 | 2½ | 1 3 2 |
| *Iron Naves.* | | | |
| No. 144. Carts, Maltese, Marks III and IV, forge and forage .. .. .. | 5 0 | 3 | 1 2 21 |
| No. 145. Wagon, R.E., hind, and water carts, Marks III and IV .. .. .. | 4 8 | 3 | 1 2 4 |
| No. 146. Wagon, R.E., cable, hind .. .. | 4 8 | 3 | 1 2 22 |
| No. 147. Wagon, G.S., lock under, Marks III and IV, and transport, Mark I, hind, and tip cart, G.S. .. .. .. | 4 8 | 2½ | 1 2 6 |
| No. 148. Wagon, ambulance, Marks III and IV, pharmacy and surgery, hind .. | 4 8 | 2½ | 1 1 10 |

| Designation. | Diameter. | Width of Tire. | Weight. | | |
|---|---|---|---|---|---|
| | ft. in. | in. | cwts. | qrs. | lbs. |
| No. 149. Wagon, ambulance, converted from light supply, hind.. .. .. .. | 4 6 | 2 | 1 | 0 | 24 |
| No. 150. Wagon, R.E., fore .. .. .. | 3 4 | 3 | 1 | 0 | 18 |
| No. 151. G.S. wagon, lock under, Marks III and IV, fore .. .. .. .. | 3 4 | 2½ | 1 | 0 | 20 |
| No. 152. Wagon, ambulance, Mark III, pharmacy and surgery, fore .. .. | 3 0 | 2½ | 0 | 3 | 22 |
| No. 153. Wagon, ambulance, converted from light supply, fore .. .. .. .. | 3 0 | 2 | 0 | 3 | 17 |
| No. 154. Wagon, ambulance, Mark IV, fore | 4 0 | 2½ | 1 | 1 | 3 |
| No. 155. Wagon, transport, Mark I, fore .. | 4 0 | 2½ | 1 | 2 | 1 |
| *Wood Naves.* | | | | | |
| No. 162. Carts, forge, forage, and Maltese, Marks I, II, III, and IV.. .. .. | 5 0 | 3 | 1 | 1 | 12 |
| No. 163. Wagon, G.S. lock under, Marks III and IV and powder, hind, tip cart, G.S. | 4 8 | 2½ | 1 | 2 | 6 |
| No. 164. Wagon, G.S. lock under, Marks III and IV and powder, fore .. .. | 3 4 | 2½ | 1 | 0 | 20 |
| No. 165. Wagon, transport, Mark II, hind | 4 8 | 2½ | 1 | 1 | 0 |
| No. 166. „ „ „ fore | 3 9 | 2½ | 1 | 0 | 0 |
| C Pattern. | | | | | |
| 2nd Class. *Metal Naves.* | | | | | |
| No. 36. 12-pr. B.L. carriage, limber and ammunition wagon .. .. .. | 5 0 | 3 | 2 | 0 | 10½ |
| No. 39. Carriage, field, limber, and ammunition wagon, R.M.L. 16-pr. limber and wagon forge Mark II and store .. .. | 5 0 | 3 | 2 | 1 | 5 |
| No. 40. 13-pr... .. .. .. .. | 5 0 | 3 | 2 | 0 | 13 |
| *Iron Naves.* | | | | | |
| No. 37. Wagon, artillery, fore .. .. | 3 6 | 2½ | 1 | 0 | 10 |
| No. 38. Wagon, artillery, hind .. .. | 5 0 | 2½ | 1 | 2 | 0 |
| No. 201. S.A. Ammunition cart .. .. | 5 0 | 2½ | 1 | 2 | 6 |

Construction of No. 25 wheel (Plate IV). L. of C., § 3016.

The following description of the No. 25 wheel with metal nave will illustrate the construction of all wheels of that pattern:—

The nave is in three principal parts; namely, the pipe box A, the inner flange B, and the outer flange C.

The pipe box, of phospor bronze, internally is cy[illegible]al in shape, enlarged towards the middle to form a grease cham[illegible], and having grooves cut in the bearing parts for the better distribution of the grease; externally its surface is that of two conical frustra of different slope, standing base to base, one base being of slightly larger diameter than the other so as to form a shoulder for the inner flange to bear against. A wrought-iron feather is let into the pipe box on which the inner flange fits, a slot being cut in the latter to receive it, which ensures the pipe box revolving with the flange and remainder of the wheel. In length the pipe box is 10″, or 3″ shorter than the light field wheel with wood nave. The flanges are of metal, and are softer than the pipe box. The surface of the outer flange, against which the spokes bear, is so formed as to give the required amount of dish to the wheel. The flanges when in position upon the pipe box project a little beyond each end of the latter, the shoulder of the axletree and the washer entering the recesses so formed. The outer flange is secured to the inner by a wrought-iron bolt D, triangular in cross section, between each pair of spokes;

the bolt holes in the outer flange are triangular and in the inner circular, and the bolts are nutted upon the inside. Over each bolt, to exclude moisture, a bit of elm is fitted and held by nails to the adjacent spokes.

The spokes differ from those of the wood naved wheel principally in the shape of the feet, which are cut so as to form a perfect arch round and resting upon the pipe box, completely filling the space between the latter and the bolts. African oak, Sissoo and Pedowk have occasionally been used for spokes as a substitute for English oak.

The felloes are the same as in the wood naved wheel, except that they are not cut away so much on the bosom and are $\frac{1}{4}''$ deeper.

The wheel is shod with a ring tire $\frac{5}{8}''$ thick. The date of manufacture is stamped upon the back of one of the felloes. Sissoo has occasionally been used for felloes as a substitute for ash.

The other wheels belonging to pattern B are generally similar in construction, neglecting dimensions, the most important of which are given in the table, the following are the main points of variation.

FIRST CLASS.

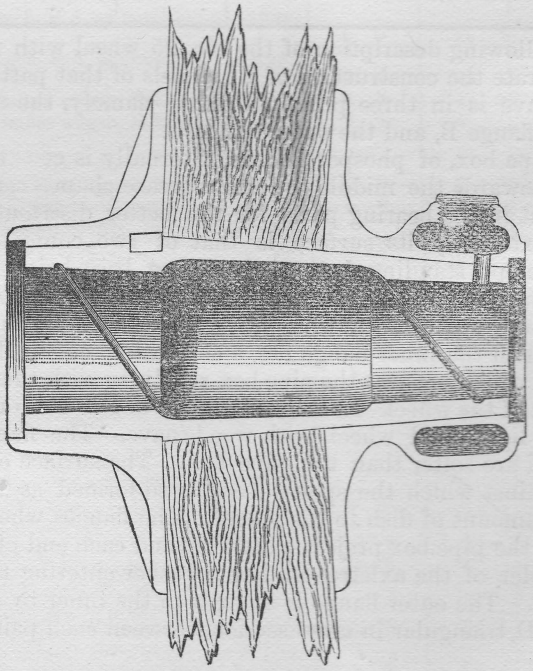
§ 3015. In the wheels belonging to the first class the flanges of the nave do not project beyond the ends of the pipe box (see Plate V), and the tire is attached by two bolts through each felloe.

§ 4004. No. 7. The flanges of the nave are of M.C.I., the outer flange is formed with a grease chamber, with three filling holes, closed with gun metal plugs, fitted to take the G.S. plug key. Channels lead from the chamber to the interior of the pipe box.

The edges of the tire are rounded.

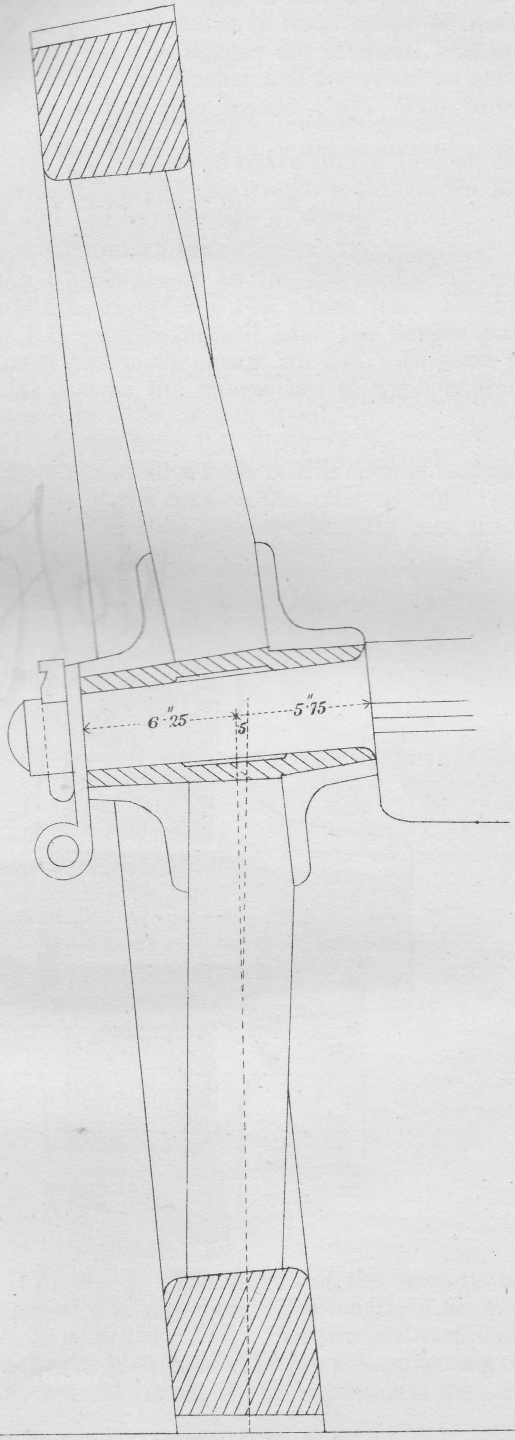
No. 107. The flanges are of wrought-iron.

Fig. 1.



# SIEGE WHEEL, 1ST CLASS B. Nº 6.

*Scale 1½″=1′*




12451.

DANCERFIELD. LITH 22. BEDFORD ST COVENT GARDEN.

SECOND CLASS.

No. 24 is superseded by No. 25. The pipe box was made of hard metal, and the felloes much cut away at the bosom.

No. 26, Fig. 1, has a grease chamber in outer flange of nave, similar to that for No. 7, but the flanges are of metal, and are recessed at the ends to receive the washer and the collar on axletree arm, formed by the end of the tensile stay. The inner flange has six strengthening ribs cast on it. § 4237.

Nos. 32, 33, 130 and 131 have wood naves similar to that described for No. 15, but with P.B. pipe boxes similar to that for No. 25.

Nos. 121, 122, 123 and 124 have flanges of wrought-iron.

THIRD CLASS.

In this class, all the wheels shown in the list as having iron naves have flanges of M.C.I., except No. 149, which has wrought-iron flanges, and have P.B. pipe boxes; all have the flanges projecting beyond the ends of the pipes, except No. 144. In some of the earlier wheels of this pattern, the flanges are of wrought-iron, and in some, manufactured in 1882, of gun metal. § 2167. § 2542.

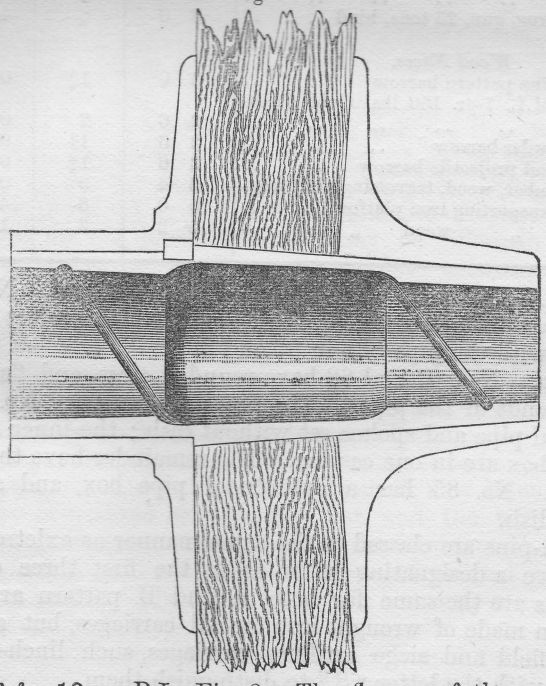
The wood naved wheels also have P.B. pipes.

The inner end of the pipes of all wheels of this class is recessed to suit the swell at the base of the cone on the axletree arm.

The spokes for wheels of this class have occasionally been made of greenheart.

C PATTERN.

Fig. 2.



No. 36 for 12-pr. B.L., Fig. 2. The flanges of the nave do not project beyond the ends of the pipe box. The length of the pipe box is 10·995″ ± ·005″, or practically 11″. The tire is of steel ·562″ thick at centre and rounded at the edges. The dowels connecting the adjacent felloes are trapezoidal in form, and fit in grooves at the back.

Nos. 37 and 38 are similar to No. 36, but have malleable cast-iron flanges. The tires are of wrought-iron, ·5″ in thickness and not rounded at the edges.

The following table gives the wheels for naval service, and those that are special :—

TABLE OF NAVAL AND SPECIAL WHEELS.

| Designation. | Diameter. | Width of Tire. | Weight. |
|---|---|---|---|
| | ft. in. | in. | cwts. qrs. lbs. |
| *Naval.* | | | |
| *Metal Naves.* | | | |
| No. 56. 9-pr. R.M.L. steel carriage (pipe 2nd class B.) .. .. .. .. | 3 6 | 3 | 1 1 3 |
| No. 57. Gatling and Gardner .. .. | 3 6 | 2¼ | 0 3 4 |
| No. 58. 7-pr. 200 lbs... .. .. .. | 3 0 | 2 | 0 2 16 |
| *Wood Naves.* | | | |
| No. 63. 9-pr. R.M.L. wood carriage.. .. | 3 6 | 3 | 1 0 7 |
| *Special.* | | | |
| *Metal Naves.* | | | |
| No. 67. R.M.L. 2·5″ gun carriage .. .. | 3 0 | 2⅜ | 0 3 23 |
| No. 68. R.M.L. 7-pr. 150 lbs. mountain carriage .. .. .. .. .. | 2 6 | 2 | 0 2 7 |
| No. 170. Drug, gun, 25 tons, hind .. .. | 3 0 | 8 | 4 3 0 |
| *Wood Naves.* | | | |
| No. 74. China pattern barrow .. .. | 3 0 | 1¾ | 0 1 18 |
| No. 75. R.M.L. 7-pr. 150 lbs. Gold Coast carriage .. .. .. .. .. | 2 6 | 2 | 0 2 11 |
| No. 76. Powder barrow .. .. .. | 2 6 | 1¾ | 0 1 11 |
| No. 77. Road projectile barrow .. .. | 2 6 | 1¾ | 0 1 11 |
| No. 78. Limber, wood, traversing platform | 2 4 | 3 | 0 2 1 |
| No. 85. Transporting iron platform.. .. | 5 0 | 6 | 4 1 14 |
| No. 86. „ wood „ .. .. | 4 2 | 3 | 1 1 21 |

*Naval.*—The naval wheels have all rounded tires. Nos. 56, 57 and 58 have flanges of metal, the ends of which project in 56, and are flush with the pipe box in 57 and 58.

*Special.*—Nos. 67 and 68 have rounded tires and flanges flush with the ends of the pipes. The pipes are of P.B. No. 170 has a cylindrical pipe and spokes set without dish ; the inner flange and the pipe box are in one casting. The remainder have the pipes of cast iron. No. 85 has a cylindrical pipe box, and spokes set without dish.

Linch-pins.

Linch-pins are classed in the same manner as axletrees, but do not receive a designating letter, as in the first three classes the linch pins are the same for both A and B pattern arms. They have been made of wrought iron for all carriages, but are now of steel for field and siege artillery carriages, such linch-pins being stamped with the letter "S," to distinguish them.

The body of a linch-pin is rectangular in section, having a slot at the lower extremity for a leather tie, or in pins for second class wheels with iron naves a steel key. The head of the linch-pin is

flat at the back and in continuation of the body, but on the face it has a notch, so that the pin can easily be knocked out should there be any difficulty in withdrawing it from the axletree arm.

The linch-pin for the artillery wagon is special, see page 24.

Washers. Washers are classified as first, second, or third, and are denoted by the letters A, B, or C, according to the axletree arms for which they are intended, and as in the case of axletree arms, there are certain special washers, which do not belong to any of these classes. There are three descriptions, plain, drag and loop. The drag washer has an eye formed on it to receive the hook of a drag-rope. The loop washer is intended for siege limbers, and has a short loop to receive the hook of the outrigger stay.

The washer for the artillery wagon is special, see page 24.

## CHAPTER II.—EXAMINATION AND REPAIRS.*

Examination of wheels. Wheels should not be allowed to stand in the same position too long, particularly if the place is wet, and should be frequently examined.

Swelling of the wood is a sure indication of decay: if suspected, decay may be tested for by striking the part with a hammer, when a dull "thud"-like sound confirms the suspicion: a pricker should then be forced in and a portion of the fibre wrenched out and examined.

As the paint preserves the surface, it is necessary in testing to drive the pricker through the hard surface and ensure reaching any unsound part beneath.

Repair of a wooden nave. In wheels with a wooden nave that part of the stock immediately behind the mortise holes is most likely to decay. Small faults may be cut out and a piece of wood let in. Small cracks or openings in the wood, provided they are in the direction of the axis of the nave, are not detrimental and may be filled in with hard stopping or putty; but cracks across the nave between the spokes show weakness, and, if extensive, condemn the wheel. The nave hoops frequently become loose from shrinkage of the stock, in which case they should be removed, a piece cut out, the hoops re-welded, and shrunk on again.

The pipe box should be examined to see that it has not become too much enlarged; it sometimes becomes loose in the stock from heavy work, or from heating, and then requires to be re-wedged in; if from the latter cause, the hole in the stock may be enlarged, and grease have penetrated between the box and the wood. In this case, before re-wedging, the pipe box must be removed, freed from all grease, and packed round with a piece of painted canvas. In re-wedging, care must be taken to get the box truly concentric with the ring of the wheel.

A wheel with a wooden nave, when returned for examination and repair, should always be tested for concentricity of the pipe box.

* For details and technical instructions on the points in this chapter see "Handbook for Military Artificers."

Repair of metal nave.

§ 3991.

Should any part of a metal nave be damaged seriously it can be replaced. The clearance allowed between the pipe box and the arm in manufacture for field and siege artillery carriages is ·050″, and for transport ·032″ in the diameter. When the pipe has become decreased in length from wear, so as to cause a rattle on the arm, a leather collar will be placed between the outer end of the pipe and the washer.

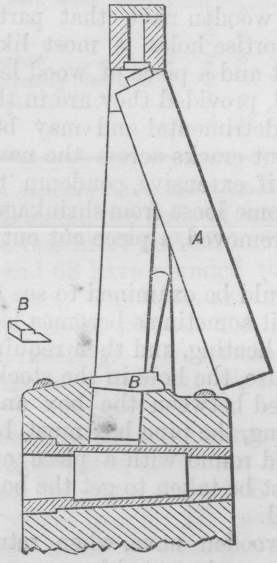
This collar may be prepared from any suitable piece of leather, and should be of such thickness as to leave a play for the wheel on the axletree arm of $\frac{1}{20}$ inch.

Repair of spokes in a wheel with a wooden nave.

Spokes are not very liable to decay, but in a wheel with a wooden nave they may become loose either from heavy work or from shrinkage of the stock. This is remedied by removing the tire, cutting very thin slices off the ends of the felloes, at one or more of the joints (running a saw through the joint is generally sufficient, taking care not to cut the dowel pins), and then replacing the tire, previously shortened.

A broken spoke may be temporarily replaced in a wheel with a wooden nave, as follows: the spoke is sawn across close to the nave and to the felloe, a shallow slot cut with a chisel in the nave over the foot of the broken spoke, inclining upwards from the face of the nave, and about 1″ of the tongue removed from the felloe. A new spoke A, with a short tongue and the foot shaped to the incline of the slot, is then inserted in the felloe, and driven up the slot in the stock. When in position, the new spoke is secured by

Fig. 3.




a small piece of wood B, nailed in front of it in the slot. In making this repair in the wood naved wheels of the R.A. aud G.S. wagons, Mark IV, it is necessary to remove the outer nave hoop.

Repair of spokes in a wheel with metal nave.

To replace temporarily a damaged spoke in a wheel with a metal nave, the inner flange and pipe box are removed, and the damaged spoke, if not already broken, cut across near the foot. The upper part is then removed from the felloe either by knocking it out or by cutting it off and making a fresh hole about 1″ deep for the tongue of the new spoke. Half of the foot at the back is next split off with a chisel, so making a partial space for the foot of the new spoke, yet leaving a piece of the old to retain the feet of the other spokes in position. The new spoke with a short tongue is then carefully driven in, the piece of the old spoke being knocked from beneath its foot when necessary. Finally, any part of the foot projecting inside the circle of the other feet is cut off, the foot is painted, and the parts of the nave replaced.

No two adjacent slip spokes should be allowed in a wheel, except in cases of emergency, and the first opportunity should always be taken of exchanging any such wheels; and no more than two slip spokes should be allowed in any wheel.

Repair of felloes.

The felloes are the most vulnerable part of a wheel; decay usually commences at the extremities immediately under the tire, from moisture penetrating at the joints. The felloes are liable to droop at the joints, causing openings at the bosom. This defect is remedied by removing the tire, and cutting small wedged-shaped pieces off the ends of the felloes, shortening the tire to correspond, and putting the wheel together again.

To put a new felloe in a wheel, the felloe is first shaped and cut to accurate length by the old felloe, then bored, the ends painted, and the dowels put in. The tire and old felloe being removed, the adjacent ends of the next felloes are knocked up a little to allow of the new felloe with its dowels being placed. This being done, and the adjoining felloes at the same time knocked down again, the tire is re-shrunk on. In this operation it sometimes happens that the tongues of the spokes get broken, in which case the spokes must be renewed.

In a wheel shod with a ring tire a damaged felloe may be replaced as a temporary measure without removing the tire, as follows:—In a finished new felloe four rivet holes are bored from side to side, and the felloe sawn vertically down the centre. The old felloe being removed, the parts of the new are placed in position on the wheel, and burrs being placed under the ends of the rivets, riveted together.

Forming a ring tire.

A bar of wrought-iron of required width and thickness is selected, and cut to proper length, which is obtained in the following manner:—

The circumference of the wheel to be shod is measured with a traveller at the centre of the sole of the felloes, and the length is marked on the bar. The total amount of the openings of the joints of the felloes on the centre of the side is measured, and a deduction made from the length marked on the bar of double the amount, if the total openings do not exceed $\frac{1}{2}$″, but of not quite double, if they do. A length equal to the thickness of the tire is then added to allow for loss in welding.

One end of the bar is upset and scarfed.

The bar is laid on the ground with the scarf downwards, a wheel is chained securely to one end, and the bar is bent by forcing the wheel along it; the wheel is then removed, and the ends of the bar bent inwards on the anvil.

The unscarfed end of the bar is then upset and scarfed, the ends are first riveted and then welded together. The circumference of the tire is measured with the traveller at the centre on the inside, if found too short it can be drawn out, but if too long must be cut, shortened and rewelded.

The tire is beveled to suit the sole of the felloes after which it is ready for putting on.

Putting on a ring tire.

The tire is placed on stones a few inches above the ground, its larger diameter uppermost, a wood fire, if possible, is made round it, and it is raised to a dull red heat. A few stones or pieces of wood or iron, are placed with their upper surfaces level, at a short distance from the fire for the tire to rest on. The pipe box should be removed from the wheel to be shod, and the outer and inner flanges connected by two or three tire bolts, which should be double nutted. When the tire is sufficiently hot it is carefully drawn out of the fire so as not to bend it, picked up with three or four pairs of tongs and placed fairly on the stones. The wheel is then placed *face downwards* inside the tire. As soon as the wheel is in its proper place it should be weighted at the nave, and water should be poured all round on the tire and felloes.

When wheels are in use the tire bolts should be looked to and kept tightly nutted.

Use of grease in repairs.

Grease must not be used to facilitate any operation in putting the parts of a wheel together, as it prevents firm union; water may, however, be used.

Painting after repairs.

After repair, the repaired parts are patched over with paint, and if the wheel requires it, a coat is also given to it all over, any cracks, &c., being previously stopped with putty.

Interchangeability of wheels for transport service.

In the third class, wheels of A and B pattern, can be made interchangeable. To adjust a B pattern wheel with iron nave to run on an A pattern arm, it is necessary to cut off the inner flange of the nave flush with the end of the pipe box.

B pattern wheels with wood naves will run on A pattern arms, without adjustment.

To adjust an A pattern wheel to run on a B pattern arm, it is necessary to rimer out the inner end of the pipe box, to fit the enlargement at the base of the cone of the arm.

## Examination and Repair of Axletrees.

A broken axletree may be re-welded in one field forge; care must be taken in the operation to preserve the proper length of the body, so as not to alter the track of the wheel.

The arms of an axletree require occasional examination as to their set, and to see that they have not worn away too much at their bearings. The set of an arm is tested by means of a straight

edge or string, and should it require alteration as to set, it is given by laying the arm in the required position upon an anvil and striking the body of the axletree carefully at the shoulder.

If an arm has become worn away at its inner bearing a piece can be welded in at that part, the arm being worked to the proper form during the operation and afterwards brought to accurate dimensions by filing; it is, however, a nice operation and can only be undertaken by a skilled workman. If too much worn at its outer bearing, the arm may be heated and upset at the point, then filed to correct dimensions and the linch-pin hole extended to give the wheel sufficient room.

Should the shoulder of an axletree be worn, so as to give the wheel too much play, it may be remedied by upsetting the arm, as just mentioned, squaring the shoulder, and then drawing out the body a little, if required, to bring the track of the wheels correct.

ALTERATION OF 13-PR. AND 16-PR. AXLEARMS TO SUIT C PATTERN WHEELS.

*13-Pr. Batteries.*

Block up the body to a convenient height before removing the wheels, and in such a position that it may be readily turned over.

Scribe a line 12·64″ from the outside edge of the linch-pin holes, round the circumference of the axletree stays with a pair of compasses, and mark a square on the face of the stay tangential with the arm.

Chip the material away with a cross cut chisel, close up to the line on the circumference, taking care not to go below the square marked on the face; then cut away the corners and trim off. File the face with a 14″ safe edge bastard, down to the scribed line, and finish off with a 14″ safe edge smooth. Great care must be taken in carrying out this operation, not to cut into the arms with the tools used.

NOTE.—This alteration to the carriage and limber will be greatly facilitated by the removal of the axletree stays. If this be done, great care must be taken to replace them in their exact position.

*16-Pr. Batteries.*

The body is to be blocked up as for the 13-pr. and the collar on the axle arm cut away flush with the shoulder, in a similar manner to that already described. Care must be taken to follow the taper of the arm, and to file a flat surface on the face of the shoulder.

On no account must chisel indentations be made in the angle of the arm and shoulder, as this cutting away will tend to weaken the axletree.

*Drag Washers and Shaft Irons.*

The drag washers and shaft irons for these services are scribed off a $\frac{1}{2}$″ from the face of the rim, and the material cut away with a flat chisel; the face is then filed with a 14″ safe edge bastard and finished off with a 14″ safe edge smooth, until the thickness of the washer all round is $\frac{7}{8}$″.

NOTE.—With B wheels, shoulder and point washers will be used to compensate for the difference in length of the Indian pipe box.

Linch-pins.

Linch-pins occasionally require straightening, for which purpose they must first be slightly heated; they are liable to be worn by the washer, in which case they must be re-formed to bring them straight at the back.

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# SECTION II.—FIELD ARTILLERY CARRIAGES.

## CHAPTER I.—WOOD CARRIAGES.

The following table gives the wood field carriages, which may be still considered as in the service:—

| Nature. | Weight. | | Tonnage. |
|---|---|---|---|
| | Empty. | Packed. | |
| | cwts. | cwts. | Tons. |
| R.B.L. | | | |
| 20-pr. carriage, with limber complete .. | 28 | 48½ | 5·18 |
| „ wagon „ „ .. | 23¾ | 38¼ | 6·5 |
| 12-pr. carriage „ „ .. | 23½ | 37 | 4·48 |
| „ wagon „ „ .. | 28 | 43¼ | 6·5 |
| 9-pr. carriage „ „ .. | 21 | 31¼ | 4·4 |
| „ wagon „ „ .. | 28 | 40¼ | 6·5 |
| 6-pr. carriage, service „ .. | 11¾ | 15¾ | 2·7 |
| „ wagon „ „ .. | 15 | 19 | 2·6 |
| „ carriage, special „ .. | 16¼ | 21½ | 4·2 |
| „ wagon, „ „ .. | 22 | 33¼ | 4·1 |
| S.B. | | | |
| 24-pr. howitzer carriage, with limber complete | 25½ | 42 | 5·15 |
| „ „ ammuntn. wagon „ .. | 25½ | 39¼ | 5·9 |
| 12-pr. gun carriage „ .. | 24 | 45¼ | 5·82 |
| „ ammunition wagon „ .. | 27 | 40 | 7·0 |
| „ howitzer carriage „ .. | 22¼ | 31¾ | 4·52 |
| „ „ ammuntn. wagon „ .. | 24 | 35½ | 5·9 |
| 9-pr. gun carriage „ .. | 23¼ | 40 | 5·02 |
| „ ammunition wagon „ .. | 25½ | 38 | 5·9 |
| 6-pr. gun carriage „ .. | 21 | 30½ | 4·52 |
| „ ammunition wagon „ .. | 24 | 37¼ | 5·9 |
| 3-pr. gun carriage „ .. | 8¾ | 13½ | 1·92 |
| 4⅖″ howitzer „ .. | 9¾ | 13 | 1·92 |
| R.M.L. | | | |
| 7-pr. 150 lbs. Gold Coast „ .. | 2½ | 3¾ | ·515 |
| Wagon, R.A., ammunition and store, Mark II.. | 20 3 0 | 47 1 24 | 4·659 |
| Wagon, artillery, Mark I „ .. | 14 2 0 | 29 2 0 | 4·729 |

The following is a brief description of the 12-pr. R.B.L. carriage, limber and wagon, which may be taken as types of the others.

The 12-pr. gun carriage consists of the following principal parts, namely, the trail, two brackets, the axletree, axletree bed, and wheels. 12-pr. R.B.L. gun carriage.

The trail is of oak, usually in one piece, but sometimes in two joined longitudinally; it is fitted with a trail plate with steeled eye for attachment to the limber. The brackets are of oak or elm, attached to the trail by dovetailed housings and by three bolts. The axletree bed of oak is housed both into the trail and brackets, and is secured by axletree bands, which, together with yoke bands and coupling plates, also hold the axletree in the bed. The axletree is No. 14, giving the wheels, which are No. 15, a track of 5′ 2″.

The carriage is fitted with a traversing arrangement, which consists of a metal saddle carrying the gun in trunnion holes, and secured by capsquares. This saddle slides in dovetailed slots in the trunnion plates, and is traversed by means of an iron lever pivoted upon the trail. The lever is worked by a traversing screw resting in bearings on the brackets, and fitted with a hand wheel. Iron cleats or stops are fixed upon the trail, and allow of $1\frac{1}{2}°$ right or left deflection being given to the gun. Saddle.

The other fittings of the carriage are, a socket or pan for the elevating screw, a chain with hook for securing the gun in travelling, breast chains, trail handles, locking plates, jack plates, fittings for carrying side arms, axletree boxes, drag shoe, and small stores.

The articles belonging to the carriage are an elevating screw, side arms, axletree boxes, and a drag shoe with chain. The screw is that known as the "ball-and-socket" pattern; it is attached to the gun by a bolt and pin, and worked by handles on a wrought-iron collar fixed to a metal nut, which is in the form of a ball. The side arms are a traversing handspike and sponge of ash, the head of the latter being covered with a coating of woven hemp and canvass, tied on, and protected when not in use by a canvass cap; the other end of the sponge stave is formed to serve as a rammer, and at certain points along the stave there are copper rings as marks. The axletree boxes are "right or near" and "left or off;" they are fitted to carry each two rounds of case and some small stores.

The limber for the gun carriage consists of a frame work formed by an axletree bed and block of elm, a splinter-bar and three futchells of ash. A platform board of ash, and footboard of elm are secured over the front of the futchells, and a slat of ash to fill the space between the splinter bar and the footboard. To the back of the block a limber hook is bolted. The axletree and wheels are the same as in the gun carriage, the former being secured in the bed by bolts and by yoke bands with coupling plates. The limber is fitted for draught, for carrying ammunition boxes, entrenching tools, &c., in the same manner as the iron limber for the 9-pr. R.M.L. (See p. 44).* The field limber.

* The rear shaft is the same as that for the iron limber. The off shaft differs in the form of the brandling iron, and is designated as 2nd Class A, to correspond with the axletree arm, on which it fits.

The articles belonging to the limber are three ammunition boxes, "near," "off," and "centre," with a canvass cartouch for each of the first two mentioned. The boxes are the same in external dimensions and in general arrangement as those of the iron limber. The near and off boxes carry each 17 rounds of ammunition, an india-rubber ring being placed under each shrapnel.

**12-pr. R.B.L. ammunition wagon.**

The ammunition wagon consists of a perch, two sides, and three platform boards of ash, two footboards and an axletree bed of elm, two fluted boards of teak, together with axletree and wheels as in the gun carriage.

The perch and sides, each of the latter strengthened by an iron plate along its outer surface, and the former fitted with a nose plate with steeled eye for attachment to the limber hook, are housed across and bolted to the axletree bed. The axletree is secured in the bed by bolts and by yoke bands with coupling plates. The boards are fitted across the perch and sides, the fluted boards being placed between the platform boards for the ammunition boxes to rest upon.

The wagon is fitted with an axletree arm block of sabicu, shod with iron, over the front footboard and front platform board, together with an elm block on the perch for carrying a spare wheel; the fittings for securing the boxes are similar to those on the gun limber; the remaining fittings are jack plates, locking plates, fitments for a drag shoe, and for carrying under boxes and stores.

The articles belonging to the wagon are six ammunition boxes, four canvas cartouches, four under boxes, a drag shoe with chain and spare lashings. The ammunition boxes are two "off," two "near," and two "centre;" the off and near are identical with those of the gun limber, except in the leather fittings, but the centre are shorter and of slightly different shape to the centre box of the limber. The under boxes are one for grease and three for horseshoes.

The wagon limber is the same as the gun limber; it has the letter "W" painted upon it for distinction.

**9-pr. R.B.L. gun carriage, &c.**

The 9-pr. gun carriage has a small transom between the brackets at the breast, and is not fitted with a traversing arrangement. Its axletree and wheels are the same as those of the 12-pr. carriage.

The limber and the ammunition wagon for the 9-pr. are the same as those for the 12-pr., the internal fittings of the boxes being different.

**20-pr. R.B.L. gun carriage, &c.**

The 20-pr. gun carriage is fitted with a traversing arrangement, differing slightly in detail from that of the 12-pr. It takes No. 14 axletree and No. 14 wheel.

The limber has also No. 14 wheel, but, except in the internal fittings of the boxes, is otherwise the same as that of the 12-pr. The ammunition wagon is the same as the 12-pr. wagon, except in the internal fittings of the boxes. The centre box is fitted with a movable block in the centre compartment, so as to raise the fuze-box to the level of the top of the box.

6-pr. R.B.L. gun carriages.

There have been carriages of two different patterns made for the 6-pr. gun, viz., the "service" pattern for the colonies generally, and the "special" pattern for use in Kaffraria; they are made of such foreign wood as is suited for the climate for which they are intended. Both patterns have third class wheels and axles; the wheels of the service pattern are 4′ 2″ in diameter, with a track of 3′ 10″, while the wheels of the special pattern are 5′ in diameter, and have the usual track for artillery carriages of 5′ 2″.

6-pr. R.B.L. limbers.

The limber for the service gun carriage consists of a simple frame, with a narrow platform board across the front, secured to an axletree bed. The axletree and wheels are the same as for the gun carriage. The limber is fitted for single draught with special moveable shafts, and carries three long boxes, the off and near boxes open at the sides next the wheels, and are not fitted with guard irons.

The limber for the special gun carriage is similar to the field limber, but has third class wheels and axles, the same as its own gun carriage.

6-pr. R.B.L. ammunition wagons.

There have been two patterns of ammunition wagons for the 6-pr., corresponding to the gun carriages, both similar in construction to the 12-pr. wagon, and each taking the same wheels and axles as its own gun carriage. The service pattern carries three boxes, the same as those on the gun limber; it has no axletree arm block for the spare wheel, but carries the latter on the perch. In both cases the same limber serves for the wagon as for the gun carriage.

S.B. ordnance.

Carriages for S.B. guns and howitzers are generally similar to those for R.B.L. guns, but are not fitted with a traversing arrangement. They are all, except the 12-pr. gun carriage, fitted with ball and socket elevating gear, similar to that for the 12-pr. R.B.L., but with the socket attached to the trail by two bolts instead of four.

12-pr. S.B. gun carriage.

The 12-pr. S.B. gun carriage is fitted with a detached cross-handled elevating screw of W.I., working in a nut fixed to a W.I. plate attached to the trail by four bolts.

### 7-PR. 150 LBS. R.M.L. WOOD CARRIAGE FOR GOLD COAST.

Plate VI. § 3060.

The brackets are of wood, tapering towards the trail eye. A box is fitted between them, having compartments, in which may be carried two case shot, two cartridges, friction tubes, and spare stores.

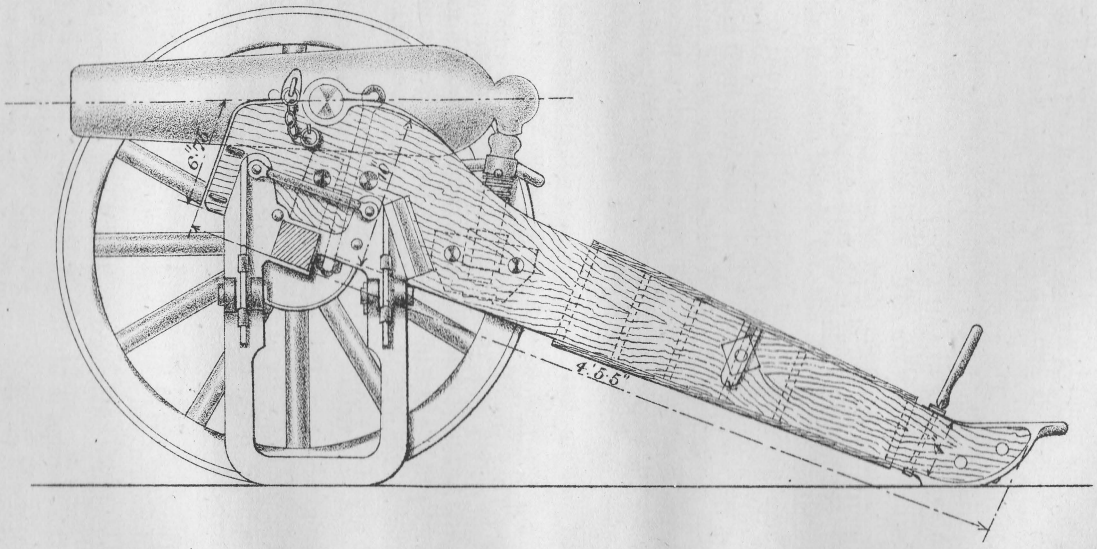
The carriage is fitted with a detached elevating screw, giving 20° elevation and 5° depression,

The wheels are No. 75, special pattern; diameter, 2′ 6″; width of tire, 2″.

The carriage is fitted with wrought-iron standards, hinged to the brackets, on which it can be supported in action, the wheels being first removed. The standards are kept rigid when in use, by two pins on each side. When not in use, they fold underneath the carriage, and are secured by a strap attached to the front transom.

Straps with round eyes, are attached to a staple on the top of

# CARRIAGE, 7 PR. 150 LB. R.M.L. WOOD, GOLD COAST.




To face page 21.

Plate VI.

Dangerfield, Lith. 22, Bedford St Covent Garden. 12462.

the trail plate, and to a bolt in rear of the front transom, to receive a pole, when the carriage is carried by men.

ROYAL ARTILLERY WAGON, AMMUNITION AND STORE. MARK II.

R.A. Wagon. Mark II. L. of C. § 2804. Plate VIA.

The body of this wagon consists of a frame work formed by two "sides," *a*, Plate VIA, and two "summers" mortised into a front and rear, "earbed," *b*. This framework is strengthened by plates riveted on the inside: it is housed and bolted to a front "bolster," *c*, a "cross bar," *d*, and a rear bolster, *e*. In front and rear of the front bolster front and rear "wheel bolsters," *f*, *f*, are bolted to the summers, and to these three the upper "wheel plate," *g*, is attached. The front bolster is shod with a friction plate, and is plated at the sides.

The body is supported over the hind axle upon two "side stays," *h*, *h*, of tee iron, and a "cross stay," *i*, of round iron. Each side stay rests in an "axle block" of oak upon the shoulder of the axletree, where it is secured by "axletree staples," by a "clip plate," *j*, and by the end of the cross stay, which latter serves as a "coupling plate."

The frame is boarded over to form the bottom of the wagon and moveable sides A (1′ 8″ in height), head board B, and tail board C, are fitted to it.

A locker is formed in the front of the wagon body by a sliding partition. The lid of the locker is fitted with a raised box and driving seat, *k*, a back board, *l*, being hinged to it, and a footboard, *m*, to the head board of the wagon. A small locker, *n*, is also formed between the summers underneath the rear of the wagon.

The fore carriage of the wagon is formed of four "futchells," *o*, housed in and bolted to a "splinter bar," *p*, and a "cross bar," *q*. An upper bolster, *r*, is bolted over, and an under bolster, *s*, beneath the centre of the futchells. A wheel plate is attached to the upper bolster, to the cross bar, and to a small wheel bolster, *t*, placed in front. The upper bolster is shod with a friction plate, and both it and the lower bolster are strengthened by plates.

The frame of the fore carriage is supported over its axle in the same manner as the body over the hind axle.

The splinter bar is fitted with links to take trace hooks, and with a pair of "general service frame shafts with double bar," attached in the usual manner to shaft eyes by a pin and key. They can be placed either for single or double draught, and have fittings for country harness. The wagon is also fitted for pole draught. § 3682.

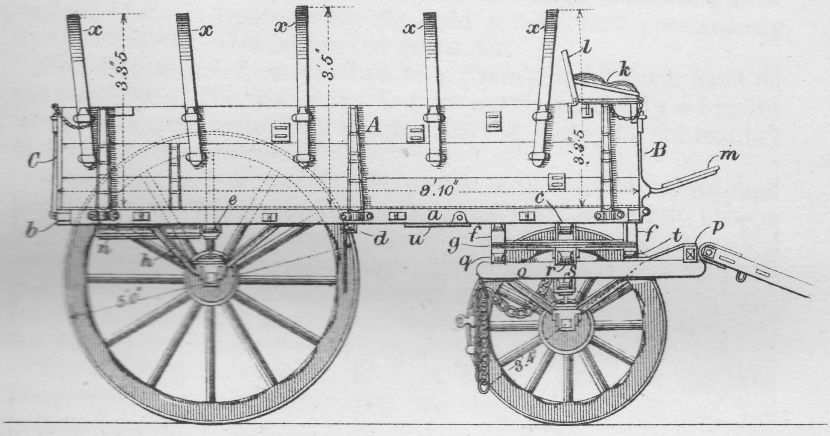
The body and fore carriage are connected by a "main pin," which passes through "bolster plates" in the main bolsters, and is keyed beneath.

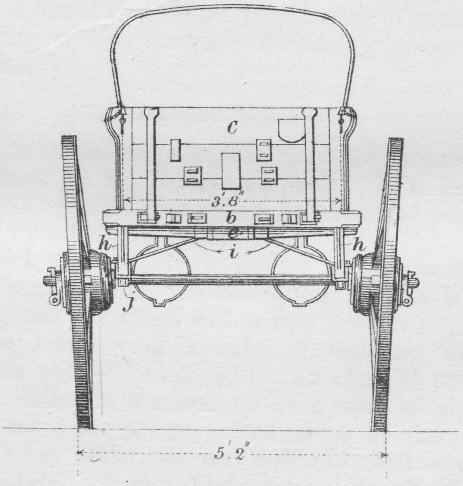
The footboard is of elm, the other boarding of yellow deal, and the remainder of the woodwork of the wagon of oak.

The fore wheels are 3′ 4″ in diameter, the hind 5″ 0″. The axles are second class; the fore axle is slightly longer than the

# WAGON, R.A. AMMUNITION & STORE, MARK II.

*Scale, about* $\frac{1}{38}$.






Dangerfield, Lith. 22, Bedford St. Covent Garden.

hind, in order to make the track of the fore wheels the same as that of the hind.

A large number of the wagons first made had wheels with wood naves, as shown in the plate: those of more recent manufacture are issued with wheels with metal naves.

The wagon is fitted to carry a spare fore wheel, entrenching tools, carbines, and swords, stores, and a drag shoe with chain. A locking plate, *u*, is attached beneath the frame to prevent the fore wheel injuring the latter in wheeling on rough ground. § 5072

The following articles belong to the wagon, namely, five "bale hoops," *x*, a waterproof "canvas cover" with the lashing rope, "bar stay," three "lashing ropes," to secure the spare wheel, and drag shoe with chain (the shoe is without the large connecting link, and the chain is lighter than for field service, and permanently fixed to the eye), also half-round grease tin.

The drag shoe is now attached to a "ram's horn" hook fixed on the near side. The shoe when not in use is carried in a bracket on the side, and secured by straps. In the plate the old manner of carrying it is shown.

The bale hoops are of ash, fitted with leather stops, and numbered from one upwards, commencing with the front hoop, a corresponding number being placed upon the wagon side at the upper staple for the bale hoop. The front hoop has also the register number of the wagon painted upon it.

The canvas cover is waterproofed with Abel's composition, and has the register number of the wagon painted upon it.

The bar stay is of ash to fit from side to side, and keep the sides from spreading out, when the wagon is packed and the tailboard down.

### Royal Artillery Wagon. Mark I.

This wagon differed from Mark II in being of greater capacity and in having higher bale hoops, and floating raves. It is now converted to Mark II. R.A. Wagon, Mark I.

### Artillery Wagon.

This wagon is intended to replace the R.A. ammunition and store wagon, Mark II. for certain purposes. It is lighter, fitted with springs, and has the connection between the body and fore carriage formed by a ball and socket joint. Artillery wagon.

The framework of the body is similar in construction to that of the former wagon, with the exception that it is longer, of lighter scantling, and not fitted with a rear bolster.

The axletree consists of a tube of weldless steel, 3·125″ external diameter and ¼″ thick, with 2nd class C pattern arms. A wrought-iron collar is screwed on each arm at the shoulder and is secured by a set screw. The sides of the wagon are supported over the axletrees on semi-elliptical steel springs linked at both ends. A clip plate formed to fit the axletree is placed on each end of it near the shoulder; a stud riveted to the clip plate fitting in a hole in the axletree. A block of wood rests on this plate; the spring rests on the block and is secured

by two bent bolts which pass round underneath the axletree, through the clip plate supporting the block, and also through a clip plate placed on the spring, above which they are nutted. The upper clip plate has a hole in it, which the head of the centre rivet of the spring enters. A cleat of elm is attached by screws underneath each side over the axletree. The washer and linch-pin are special. The washer is formed with an annular recess at the face into which a shoulder at the back of the linch-pin fits. The pin can only be withdrawn when the washer is turned so that the drag loop comes nearly vertically above the arm. A slot in the face of the washer will then come opposite the projection on the pin. There is no slot in the pin for a tie or key.

The frame is boarded over and fitted with moveable sides, head and tailboards, which are all of lighter scantling than the corresponding parts in the R.A. A. and S. wagon.

Two standards of wrought-iron connected by a cross-bar and a guard iron, all formed in one forging are fixed to each side near the front. A driving seat of deal one inch thick is supported on the cross bars, to each of which it is secured by a strap. The head board of the wagon can be used as a footboard in connection with the driving seat, being supported in position, when let down, by chains suspended from hooks on the moveable sides.

A second seat can be supported on hinged clips of steel over the sides, in rear of the driving seat, when required.

Two removeable partitions are supplied, the front one to form a locker with the head board, and to keep the sides in position when the latter is used as a footboard; the other to keep the load at the back, should the wagon not be full, or the auxilliary seat be in use. These partition boards can also be brought together to form a locker, when the footboard is turned down.

The fore carriage is similar to that of the R.A. wagon, but has no under bolster or wheel-plate; it is supported on springs over a tubular axletree of weldless steel in a similar manner to the body.

A longitudinal curved bearing plate of cast steel is fitted over the bolsters; it is attached to each of the wheel bolsters by two screws and a bolt, and is secured to the centre bolster by staples and clip plates. The centre bolster is also fitted with two friction plates.

The carriage is fitted with a pair of frame shafts, and has also fittings to receive a pole with vertical play.

The body and fore carriage are connected by a main pin arranged to form a ball and socket joint. The main pin is of steel 11″ long, tapering from 2″ diameter to 1″. The upper end of the pin is riveted into a hollow ball of gunmetal, 4″ in diameter, and ·25″ thick. The pin passes through the bolster of the fore carriage and the ball rests in a metal socket let into the bolster of the body. The socket is formed in two parts which are attached to each other, and the bolster by four ·5″ bolts. The lower part of the socket secures the ball in position, and prevents it becoming disconnected. A spiral spring, No. 2, S.W.G., is fitted

round the pin under the bolster of the fore carriage, and is secured by a steel washer and iron-split key.

A metal lubricator is fitted to the bolster of the body to lubricate the joint. It consists of a metal cylinder with a hollow stalk. which is screwed into the bolster, and projects through a hole in the top of the socket. Four grooves are cut in the socket leadiug from this hole. The cylinder is filled with grease, over which is placed a metal plug with a spiral spring, 14 S.W.G. A cap is screwed on the top of the cylinder.

To facilitate access to the lubricator there is a small trap door secured by two buttons in the floor of the wagon over the main pin.

The wagon is fitted with floating raves, bale hoops, a canvas cover, and fittings for a drag shoe.

Steel has been largely used in the fittings, the staples for the bale hoops and stud staves, the sweep plates, hinges, head and tailboards, stays for floating raves, stays connecting futchells and splinter-bar, and hawk iron being all of this metal.

The wheels used with the wagon are second class C, 11″ pipes; hind, No. 38, 5′ diameter, 2½″ tire; fore No. 37, 3′ 6″ diameter, 2½″ tire.

Special care in packing the load of this wagon is desirable. The contents should be closely packed; the bulkiest and lightest portion being over the front wheels, and the general weight of the load should be central between the sides. The ball and socket joint must be kept well lubricated, for which purpose the lubricating box must be kept well filled with C grease. To fill the lubricating box remove the small trap door secured to the floor of the wagon by two buttons, unscrew the lid of the lubricating box, extract the spring and plug, and charge the box with C grease. Insert the plug and spring, screw on the lid, and replace the trap door.

## CHAPTER II.—IRON AND STEEL CARRIAGES.

The following table gives the the iron and steel Field Artillery carriages :—

| Nature. | Weight. | | | | | | | | | Tonnage, carriage, and limber. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Empty. | | | | | | Carriage and limber packed.* | | | |
| | Carriage. | | | Limber. | | | | | | |
| | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | |
| 25-pr. R.M.L. carriage, Mark I. .. .. .. | 15 | 1 | 0 | 11 | 0 | 18 | 51 | 3 | 7 | 4·177 |
| 25-pr. R.M.L. ammunition wagon, Mark I. .. .. | 13 | 3 | 12 | 11 | 0 | 18 | 42 | 2 | 26 | 4·438 |
| 16-pr. R.M.L. carriage, Mark I. .. .. .. | 13 | 1 | 19 | 11 | 1 | 9 | 43 | 0 | 19 | 4·079 |
| 16-pr. R.M.L. carriage, Mark II. .. .. .. | 13 | 0 | 0 | 11 | 0 | 19 | 42 | 3 | 3 | 4·112 |
| 16-pr. R.M.L. ammunition wagon, Mark I. .. .. | 14 | 3 | 5 | 11 | 1 | 8 | 43 | 2 | 7 | 4·493 |
| 16-pr. R.M.L. ammunition wagon, Mark II. .. .. | 16 | 0 | 16 | 11 | 1 | 16 | 43 | 0 | 0 | 4·438 |
| 13-pr. R.M.L. carriage, Mark I. .. .. .. | 12 | 0 | 4 | 12 | 0 | 12 | 38 | 3 | 25 | 4·535 |
| 13-pr. R.M.L. ammunition wagon, Mark I. .. .. | 17 | 2 | 22 | 11 | 3 | 6 | 48 | 0 | 6 | 4·523 |
| 9-pr. R.M.L. carriage, Mark I. | 12 | 3 | 2 | 11 | 1 | 23 | 35 | 3 | 7 | 4·079 |
| 9-pr. R.M.L. carriage, Mark II. .. .. .. .. | 11 | 3 | 16 | 11 | 1 | 6 | 34 | 3 | 6 | 3·818 |
| 9-pr. R.M.L. ammunition wagon, Mark I. .. .. | 14 | 2 | 14 | 11 | 1 | 23 | 41 | 1 | 25 | 4·493 |
| 9-pr. R.M.L. ammunition wagon, Mark II. .. .. | 16 | 1 | 4 | 11 | 0 | 20 | 41 | 0 | 6 | 4·373 |
| 7-pr. R.M.L. 200 lbs. colonial carriage, Mark I. | 9 | 1 | 0 | 9 | 2 | 0 | 25 | 3 | 21 | 3·959 |
| 7-pr. R.M.L. ammunition wagon, Mark I. .. .. | 7 | 0 | 18 | 9 | 2 | 0 | | — | | 3.992 |
| 7-pr. R.M.L. 150 lbs. steel carriage, Gold Coast .. | 3 | 0 | 21 | | — | | | — | | — |
| 12-pr. B.L. carriage, Mark I. | 11 | 0 | 24 | 10 | 3 | 7 | 35 | 3 | 24 | 4·375 |
| 12-pr. B.L. ammunition wagon, Mark I. .. .. | 10 | 0 | 14 | 10 | 3 | 7 | 36 | 2 | 16 | 4·699 |
| ·45" Gatling.. .. .. | 5 | 3 | 8 | 8 | 0 | 6 | | — | | 3·423 |
| Forge wagon, Mark I. .. | 11 | 3 | 0 | 10 | 1 | 16 | 38 | 2 | 4 | 4·819 |
| Forge wagon, Mark II. .. | 14 | 2 | 24 | 10 | 3 | 0 | 42 | 0 | 0 | 5·820 |
| Store wagon, Mark I. .. | 14 | 1 | 24 | 10 | 3 | 0 | 40 | 3 | 10 | 5·820 |

* Packed for peace, spare wheel included with wagons.

## 9-Pr. R.M.L. Gun Carriage. Mark II.

9-pr. R.M.L. gun carriage. Mark II. (Plate VII.)

This carriage will take either the 8 cwt. or the 6 cwt. gun. It is formed of two bracket sides connected together by two transoms, three collar bolts, and a trail piece; an axletree bed with axletree, and field wheels.

Construction. L. of C., § 2917.

The bracket side is constructed of plate iron riveted to the inner side of a frame of angle iron.

The brackets are parallel from the front to the position of the breech of the gun, from which point they converge to the point of the trail.

The transoms are of plate iron; the second transom* has a piece of angle iron riveted to it along each side, through which it is riveted to the bracket sides at the point where they begin to converge. The front transom has a frame of angle iron riveted to it in front, through which it is riveted to the sides and bed.

The collar bolts connect the brackets between the second transom and the point of the trail; their collars bear against the plates of the brackets and keep them rigidly apart.

L. of C., § 3234.

The trail piece lies between the brackets at their points, rivets passing through from side to side to secure the whole together. This piece is continued into an eye, which is steeled to prevent wear by friction on the limber hook. In order to render it possible to replace readily and effectively the steeling when worn, it is now approved, instead of welding the steel into the iron, to slot the latter, undercutting it to make the steel to fit and secure it by two rivets. A bearing plate of steel is bolted beneath the point of the trail, and a strengthening plate above, the latter prevents the angle iron frame being bent should the limber wheel be driven over it.

The axletree bed is of wrought-iron, constituting with the axle a beam of box-girder section (see Fig. 4).

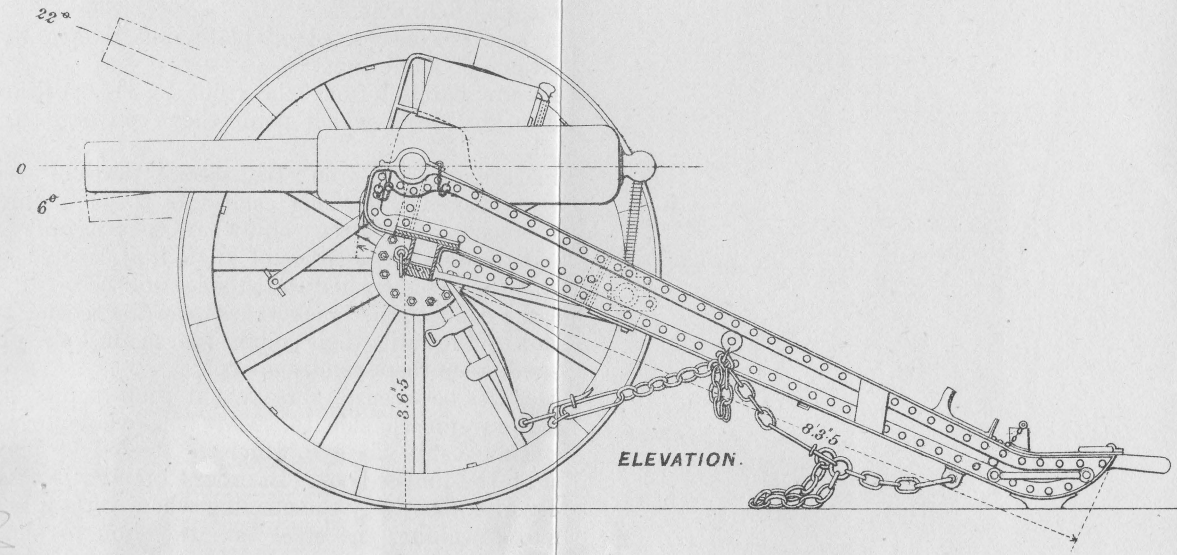
The axletree forms the bottom of the box, a piece of angle iron riveted along each side of the body the sides, while the top is formed by a plate riveted upon the upper sides of the angle iron pieces. The top plate and angle iron are slotted to admit the bed into its recesses in the brackets, where it is secured by being riveted to the frames of the latter, by angle stays riveted to itself in rear and to the frames, and by tensile stays from the shoulders of the axletree to the same.

A strengthening plate, thickened on the lower edge, is riveted on the inside of each bracket, extending from the bed to the rear transom, and lapping over the lower part of the bracket plate and over the angle stay.

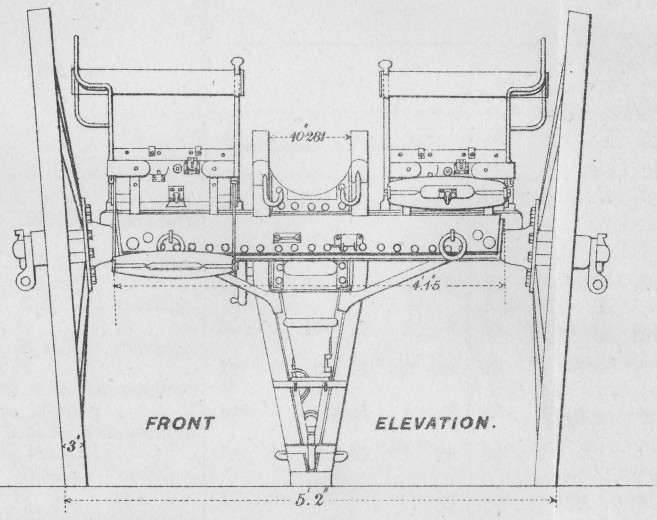
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* This transom has the centre part cut away, as opportunity offers, and a plate riveted to the back of the portion left to give space for the movement of the long tangent scale.

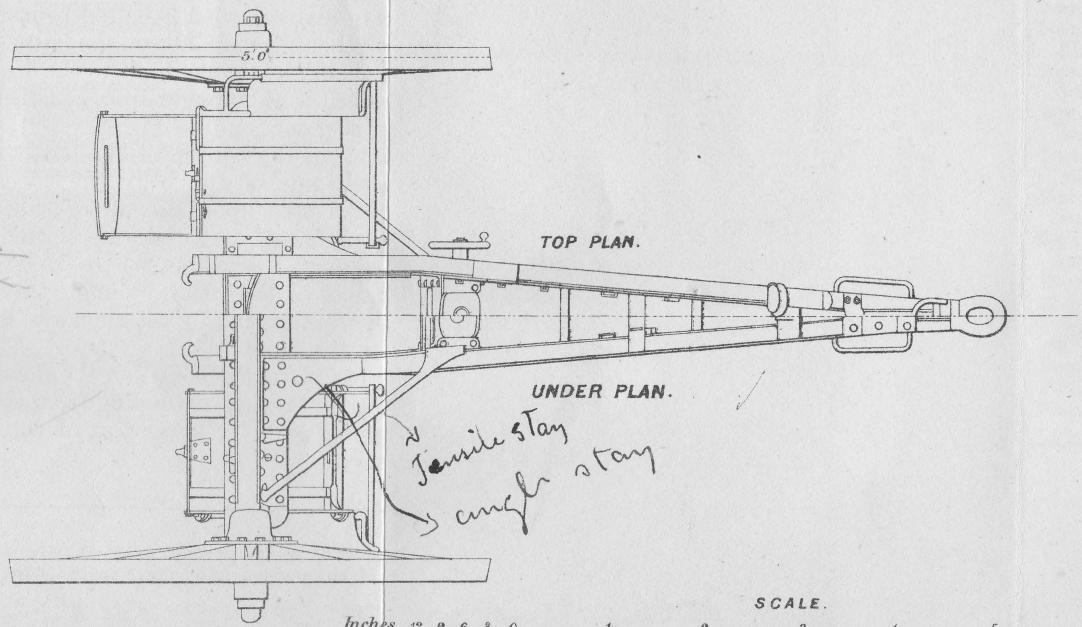
# CARRIAGE, 9 PR R.M.L. MARK II.




ELEVATION.



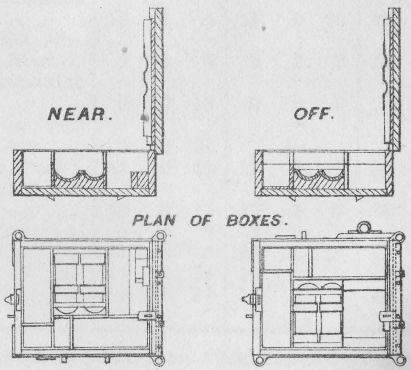

FRONT ELEVATION.




TOP PLAN.

UNDER PLAN.

BOXES, WOOD, TRAVELLING CARRIAGE, AXLETREE RIFLED. M.L. 9 PR GUN.

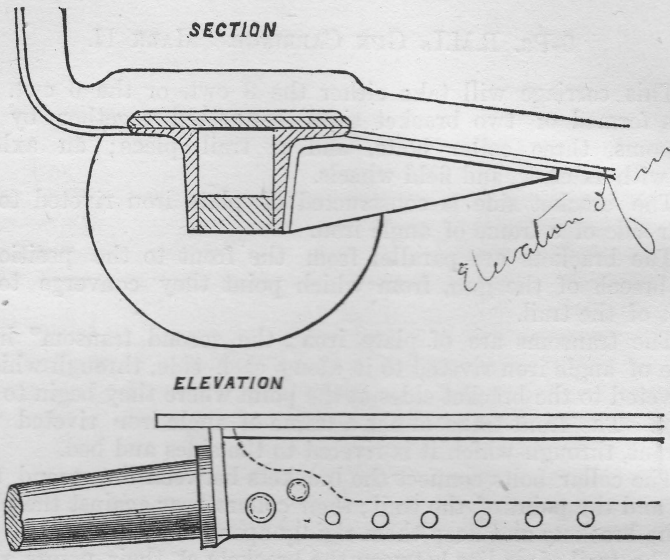



PLAN OF BOXES.

SCALE.

Inches 12 9 6 3 0 1 2 3 4 5 6 7 Feet.

Fig. 4.




The arms of the axletree are of the second class, N.P.

Fittings. The carriage has the following fittings, namely:—

Wrought-iron capsquares secured by keys over the trunnion holes.

Metal sockets, with double nutted bolts, to receive the trunnions of the elevating screw box and to support the spindle.

A staple with strap to secure the hand wheel of the elevating screw in travelling.

A handspike ring, shoe and pin on the point of the trail for securing the traversing handspike in action.

A sponge plate on the right bracket, a plate beneath the trail, and staples with straps for securing a sponge on the right bracket, a traversing handspike on the left, and a spare sponge and handspike beneath.

A metal nut under the front transom to receive, and staple with strap to secure, a wadhook worm.

A hook on the breast of each bracket.

Fittings for carrying axletree boxes, small stores, &c.

Fittings for a drag shoe and chain on the left side of the carriage.

Fittings for a deflector.

Breast rings and trail handles.

Articles belonging to. The articles made in R.C.D. belonging to the gun carriage are, an elevating screw, two axletree boxes ("right or near," and "left or off"), side arms (two traversing handspikes and two sponges, one of each being spare), a leather pocket for priming irons, a leather case to receive a tube pocket, an oil can, and a drag shoe with chain.

The elevating screw, which is known as the Whitworth pattern, Plate IX, is attached to the gun in the usual way by a bolt and is worked by a metal nut, through which it passes. Bevel teeth are cut upon the lower part of the nut, into which a bevel wheel upon a horizontal spindle gears. The nut and bevel wheel are contained in a wrought-iron box, having a trunnion upon each side which is supported in bearings bolted to the brackets. The lid of the box is secured to the bottom by four long screws and has a lubricating hole for oiling the bevel wheels, which is filled by a metal screw to keep dust and grit out; a drip hole is made in the bottom and the interior is coated with red lead. The spindle of the bevel wheel, which for future manufacture is to be of tough steel, passes through a metal bearing in the right trunnion of the box, and upon its extremity outside the right bracket of the carriage has a metal hand wheel with short iron handle by which it is worked. To remove the box from the carriage the lid has to be taken off, the pin holding the spindle pulled out, and the spindle withdrawn; after which the caps of the sockets being removed, the box can be lifted out.

L. of C., § 2494. Plate VIII.

The axletree boxes are made of yellow deal with ends of elm and internal fittings of mahogany. Each is arranged to carry two rounds of shell or case, steadied by copper shod cleats on the lid, the cartridges each in a tin box,* and small stores. The lid serves as a seat when required, it is covered with canvas, bound with copper and fastened by a spring lock and by a hasp with turn-buckle, the stop pin of the former being grooved to prevent it being jerked out on discharge. The box is strengthened by corner squares of iron and bound with an iron band, in which there are sockets for the standards of a guard iron† for the protection of a man when seated on the lid: for his feet to rest upon there is an iron step, the side pieces of which slide in staples upon the sides of the box, so that, when not required, the step can be pushed up against the front of the box and there retained by a turn-buckle for the purpose. For attachment to the axle-tree bed each box has underneath, at one side two nib-irons, and at the other two nibs through which double nutted securing screws pass. The boxes are fitted with blanket straps, and the off box has a shell key attached to the back. A leather guard from the dirt of the sponge head is fitted to the near box.

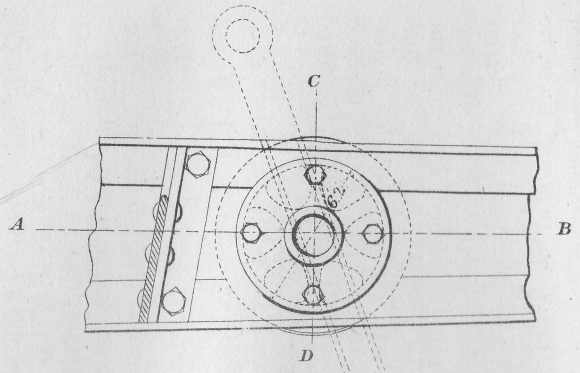
The sponge stave and the traversing handspike are of ash unpainted; the sponge head, of elm covered with fleecy hosiery, is fastened on one end of the sponge stave by marine glue and a copper band, and the rammer head, also of elm, bound with copper, on the other end, by a wood pin, or, since March, 1886, by a copper rivet: in the centre of the rammer head an iron nut is fixed, into which the wadhook (Mark I) worm is screwed for use. The stave is marked by the Royal Artillery after issue by the

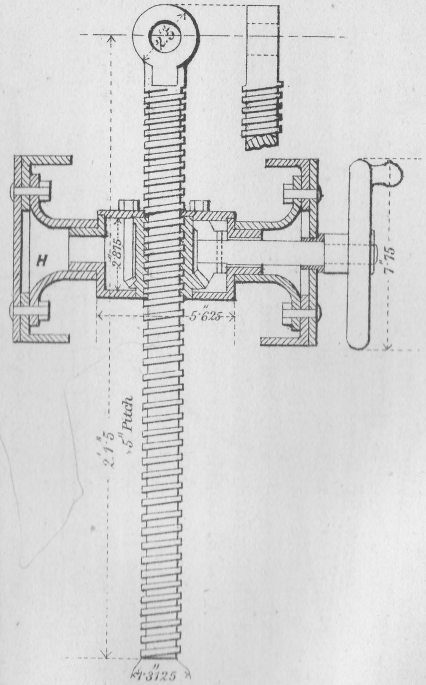
§ 4139.

* These tin boxes are made in R.C.D. and issued as part of the carriage; Mark II box is fitted with a strap inside to assist in pulling out the cartridge.

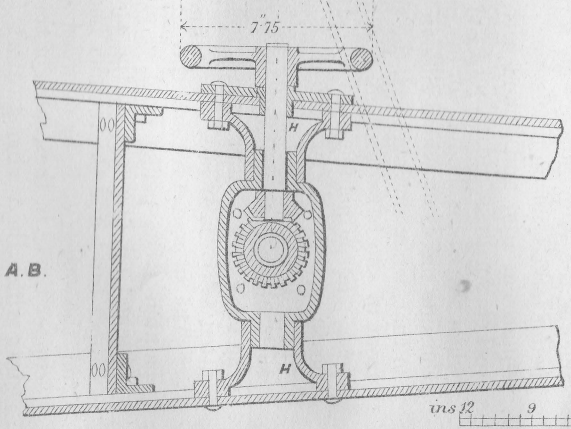
† One standard is now made of increased length in order to raise the back strap higher.

# ELEVATING ARRANGEMENT FOR 9 Pr R.M.L. GUN.




SECTION ON C.D.




SECTION ON A.B.

SCALE.

ins 12 9 6 3 0 1 2 feet.

12451.

DANGERFIELD, LITH. 22 BEDFORD ST. COVENT GARDEN.

insertion of a screw at the point which meets the muzzle, when a service charge and common shell are rammed home.

L. of C. § 2745. The sponge head is protected by a waterproof canvas cover, and the rammer head is varnished. Mark II sponge is 3″ longer than Mark I, viz., 6′ 6½″ total length, and weighs 4 lbs.

The pocket for the priming irons has a strap and buckle for attaching it to the right bracket, the strap passing round the bracket, and the pocket, for carrying the tube pocket, a strap and buckle for attaching it to staples on the inside of the same bracket.

§ 4243. The deflector Mark II consists of a pendulum swinging in front of a small steel frame, graduated with a degree scale on the front as well as on the back of its lower bar.

For use the frame is suspended by small trunnions, on its upper edge, from a loop and a hook screwed to the axletree bed of the carriage. The hook is fitted with a split keep pin to secure the deflector in travelling. A difference in the height of the wheels is indicated on the scales by the position of pointers on the pendulum.

The deflector when not required for use is secured out of action by a turn-buckle.

In Mark I deflector, the pendulum was shorter and lighter and had only one pointer.

The drag shoe is No. 3, of wrought iron, with a steel sole: it has two straps, which form a bed for the sole of the wheel. In one of the straps are loops to take a leather strap should the roughness of the ground render it necessary to secure the wheel in the shoe. The chain is No. 10, it is of ½″ wrought iron, annealed, and

§ 4619. is attached to the shoe by a tongue and slip link, the ring loop between the shoe and chain being made large enough to allow the latter to run through it. Formerly there was a ring about one foot from the extremity of the chain, for the purpose of passing the tongue through in order to shorten the chain. It has been approved that, for future manufacture, the ring shall be replaced by one of the ordinary chain links.

The most suitable link for the tongue, to ensure the wheel riding fairly in the drag shoe, should be marked by paint or some other temporary method, after the chain is placed on the carriage. As this link will vary from the chain stretching, or from the chains being interchanged the correct link should be ascertained from time to time and marked.

The wheels used with the carriage are either Nos. 25 or 27, pattern B, second class.

### 9-pr. R.M.L. Gun Carriage. Mark I.

9-pr. R.M.L. gun carriage. Mark I. § 2916. This carriage differs from Mark II in having the plate of the bracket placed upon the outside instead of the inside of the frame, in being of material of greater scantling; and in having the trail plate formed as in the old wooden carriages, lapping under and over the point of the trail.

Minor differences are; the form of the front transom, which is a simple plate between the lower part of the brackets at the breast, bent upwards to lie along the front of the axletree bed;

angle stays between the latter and the brackets in front as well as in rear; the bed much narrower in the top plate and deeper, being housed further into the brackets; and the sockets for the trunnions of the elevating screw box being made without caps.

The axle boxes are not interchangeable with those of Mark II carriage.

### 9-PR. R.M.L. GUN CARRIAGES FOR INDIA.

9-pr. R.M.L. gun carriages for India.

The 9-pr. gun carriages for India are identical with those for home services (Marks I and II), but instead of being fitted for a wooden traversing handspike have an iron tee-shaped handspike bolted on the trail. The handspike pivots on its bolts, so that when not required for use it can be turned over to lie along the trail; when in position for traversing a moveable pawl upon it catches in a stop upon the trail, and secures it until the pawl is raised.

The carriage does not carry a drag shoe but the wheel is locked, when necessary, by the chain, which is passed round the felloe, and a tongue at its extremity secured by a slip ring in a ring for the purpose on the chain itself.

### 16-PR. R.M.L. GUN CARRIAGE. MARK II.

16-pr. R.M.L. gun carriage. Mark II. L. of C., § 2919.

The 16-pr. gun carriage differs but slightly from that of the 9-pr., it is deeper in the brackets, of greater width between them and stronger at the trunnion holes.

The fittings for carrying stores are slightly different to those of the 9-pr. carriage, and the axle-tree boxes, of the same external size, have copper instead of mahogany partitions. They are fitted to carry either two rounds of case or two of shell, a moveable block, secured by a chain, being introduced to make up for the short length of the case when carried.

The traversing handspike and wadhook worm are the same as for the 9-pr.; the sponge is 6′ 9″ in total length, and weighs $4\frac{3}{4}$ lbs.

### 16-PR. R.M.L. GUN CARRIAGE. MARK I.

16-pr. R.M.L. gun carriage. Mark I. § 2918.

This carriage is similar to the corresponding carriage for the 9-pr. The bearings for the spindles of the elevating gear are, however, fitted with caps when carriages pass through R.C.D.

### 25-PR. R.M.L. GUN CARRIAGE. MARK I.*

25-pr. R.M.L. gun carriage. Mark I. L. of C., § 3091.

This carriage is similar in construction to the 16-pr., Mark II, and has the same wheels; an additional bearing piece is riveted round each trunnion hole.

For laying the gun worm wheel elevating gear is used instead of the Whitworth screw; the gear is placed upon the right side only, and consist of the following parts:—

An elevating arc of wrought iron, attached to the gun.

A pinion of wrought iron, on the inside of the bracket of the carriage, gearing into the teeth of the arc.

* This carriage when fitted with a top carriage for overbank fire is included among the siege carriages.

A friction roller of metal, also on the inside of the bracket of the carriage, to keep the arc in gear with its pinion.

A worm wheel, composite, outside the bracket of the carriage, upon the spindle of the pinion.

A worm shaft, with hand wheel, held in bearings on the outside of the bracket of the carriage, and gearing into the teeth of the worm wheel, which it drives. The wheel and worm are covered by a metal guard, forming the bearing for the spindle of the former, and made in two parts, hinged together so as to give ready access to the wheel, &c.

The worm wheel, as mentioned, is made composite in order to allow of some slip of the arc on firing, and so reduce the shock on the parts of the gear. It consists of a worm wheel proper, of metal, free to move round its axle, and having a conical recess formed in it centrally on the outer side, and of a cast-iron conical disc fixed on the axle, fitting into the recess. The disc can be forced into the latter by means of a nut, and so the slip of the arc regulated as desired.

A stool bed of wood strengthened by an iron plate along each side, a large coin and two hand coins are fitted to and issued with the carriage for use in laying the gun in case of any damage to the elevating gear. The stool bed rests in front upon the axle bed and in rear upon the rear transom, the coins are carried between the brackets. The pocket for the priming irons is strapped on the rear transom.

The other fittings and articles belonging to the carriage are similar to those for the 16-pr.; the axle boxes are of the same external dimensions as for the latter carriage, but without guard irons and steps, and fitted to carry two rounds of case and cartridges. The traversing handspike and wadhook worm are the same as for the 16-pr.; the sponge and rammer are on separate staves, each 8′ 7″ long, the former weighing 6¾ lbs:; and the latter 6¼ lbs.

### 7-PR. R.M.L. OF 200 LBS. GUN CARRIAGE, COLONIAL PATTERN. MARK II.

7-pr. R.M.L. gun carriage, Colonial pattern. Mark II. L. of C., § 3473.

This carriage is constructed on the same plan as the 9-pr. Mark II carriage. The bracket plates have pieces cut out of them for lightness.

It is fitted like the latter with tensile stays to the axletree bed, a transom plate being placed between the brackets at the points, they are riveted to the latter. The wheels are of the B pattern, third class, 5′ 0″ in diameter.

The elevating gear consists of an arc attached by a bolt to the cascable and passing through a metal bracket upon the front of the rear transom; the arc is worked by a pinion at the back of the transom, which is slotted to allow the pinion to project through it; the spindle of the pinion has a worm wheel, with friction cone, on its extremity outside the right bracket, which is worked in the usual way by a worm with handwheel.

The carriage is fitted with axle boxes which serve as seats, and

carry three rounds of case or shell. It has a drag shoe and chain, and also a second chain to lock the near wheel when necessary.

## 13-Pr. R.M.L. Gun Carriage.

§ 4237. R.C.D. Photo-lithograph 19. Plate IX.

This carriage consists of two bracket sides, connected by three transoms, a collar bolt, a collar rivet and a trail eye, and an axletree bed with axletree.

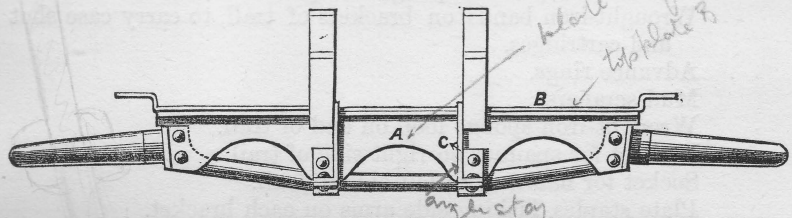
The brackets are constructed of $\frac{1}{4}$″ steel plate, riveted by $\frac{1}{2}$″ iron rivets inside the flange of an angle iron frame. The first and second transoms are of flanged steel plate, they stand on the top plate of the axletree bed, with the flanges turned inwards, and are riveted through the flanges to the inside of the brackets and to the bed. The third transom is an iron plate with flanges at each end, through which it is riveted to the brackets.

The collar bolt and rivet connect the brackets between the rear transom and the trail eye.

The trail eye is of wrought-iron, of similar form to that of the 9-pr. carriage, Mark II, but having a loop forged on it, in front, underneath, for the hook of the drag chain. It is fitted with a moveable steel. A steel bearing plate is riveted underneath the point of the trail.

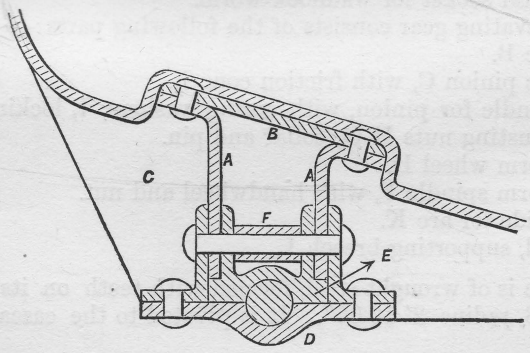
The axletree is of steel, the arms are second class, Pattern B, without a collar at the shoulder, see Plate II. The general form of the axletree is shown in Fig. 5. It is generally circular in cross section between the shoulders, diameter at centre 1·5″.

Fig. 5.

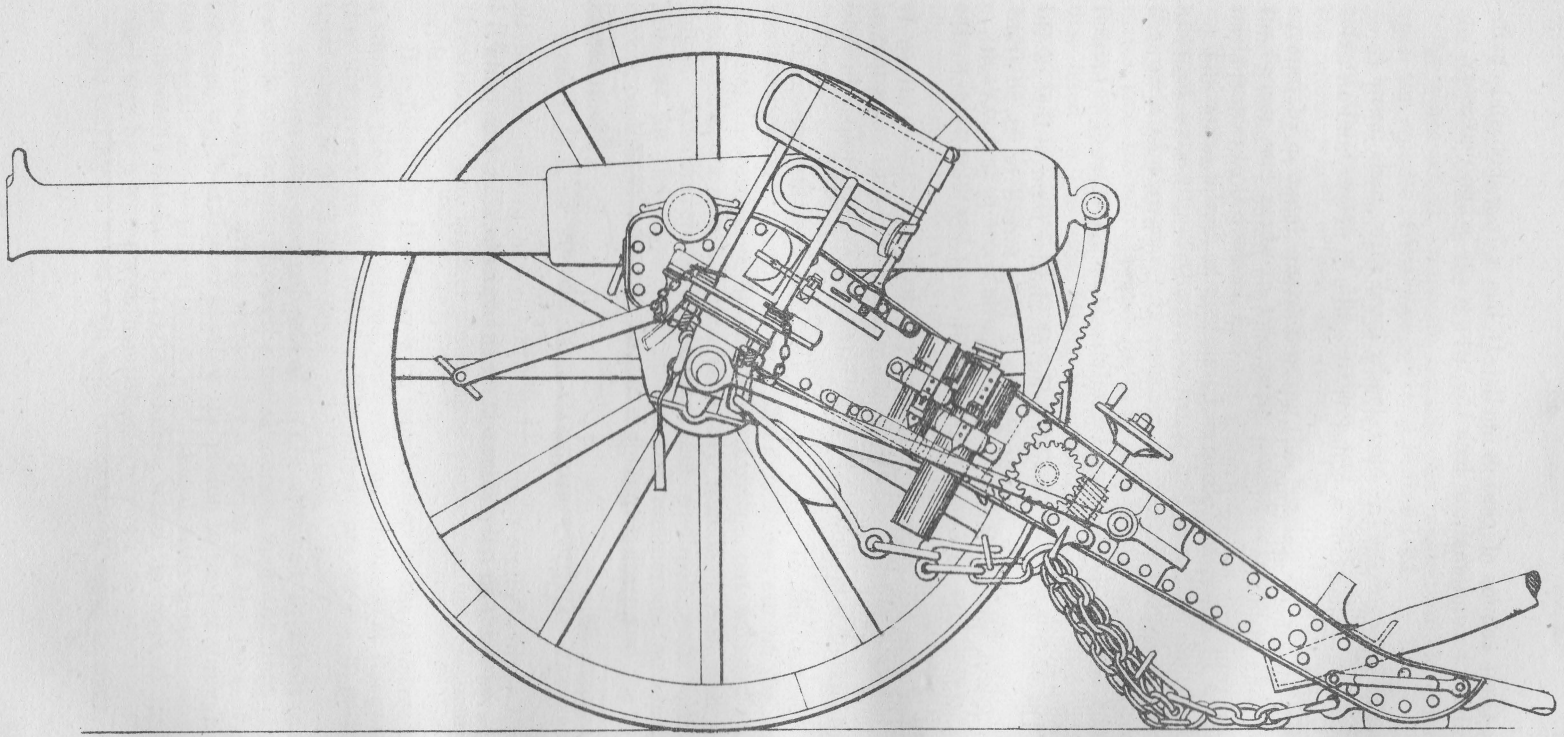



A plate of angle steel A (Fig. 6) is riveted to each side of the axletree by four rivets, two at each shoulder. A top plate B is

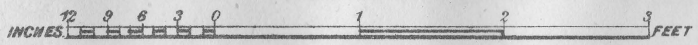
Fig. 6.



# CARRIAGE, 13 PR. R. M. L.



SCALE.




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DANGERFIELD, LITH, 22, BEDFORD ST COVENT GARDEN.

riveted over the angle plates, which are connected with the brackets by angle stays C, of wrought-iron, in front and rear, riveted to the plates, to the inside of the brackets, and to steel caps D, passing underneath the axletree. The axletree is secured in the caps by wrought-iron bearings E, which fit over, and are riveted to the angle plates and stays, each by a single rivet F, F, with a collar.

The axletree is also connected with the trail by two tensile stays of wrought-iron. These stays are formed with loops at their front ends, which fit over the axletree arm close to the shoulder, and are secured by a small set screw, the point of which enters a recess made for the purpose in the axletree arm at the front. The loop on the stay fits into the end of the inner flange of the nave of the wheel, thus serving the purpose of the cylindrical collar usually formed at the shoulder on second class arms of B pattern. The rear end of these stays are formed with eyes, which fit over the ends of the front collar bolt.

Fittings.

The carriage has the following fittings:—

Elevating gear.
Two steel capsquares with wrought-iron chains.
Axletree seats with guard irons and foot rests.
Drag shoe and chain, and four hooks for ditto.
Socket with pin for traversing handspike.
Two handles, steel.
Two locking plates, steel.
Wrought-iron bucket, lined with leather, under left bracket of trail for jointed sponge and piasaba brush.
Wrought-iron bands on brackets of trail, to carry case shot and cartridges.
Advance rings.
Mud scrapers.
Wrought-iron sponge loop on end of trail.
Bracket for spanner on right side of trail.
Socket for hammer on left side of trail.
Plate staples, lashing side arms on each bracket.
Staple for pincers, inside right bracket.
Six staples, lashing.
Two loops and hooks for deflectors on axletree bed.
Metal socket for wadhook worm.

**Elevating gear, Fig. 2. Plate X.**

The elevating gear consists of the following parts:—

Arc B.
Arc pinion C, with friction cone E.
Spindle for pinion, with spring washers, I, locking and adjusting nuts H G, collar and pin.
Worm wheel D.
Worm spindle F, with handwheel and nut.
Guide for arc K.
Pad, supporting breech L.

The arc is of wrought steel, formed with teeth on its rear edge, number 18, radius 2′ 10·06″. It is pivoted to the cascable of the

gun, and gears with the arc pinion. This pinion is of wrought-iron, 16 teeth, 5·093″ diameter; forged in one with a friction cone. It is keyed on a spindle of steel 1·5″ diameter, which rests in metal bearings, bolted to the inside of the carriage brackets, and secured by the collar and pin.

The worm wheel of metal, 23 teeth 5·49″ diameter, fits on the spindle and is free to revolve round it. It is formed with a conical recess, into which the friction cone can be pressed by screwing up the adjusting nut.

The spring washer fits on the spindle, and is pressed against the face of the pinion by the adjusting nut, which screws on the spindle on the inside of the pinion; the locking nut is on the spindle to the inside of the adjusting nut.

The worm spindle is of wrought-iron. It works in bearings formed in the right hand bracket supporting the worm wheel spindle. A metal handwheel, with iron handle is secured on the upper end of the spindle by a washer and nut.

The guide for the arc is of metal, it is attached by three bolts to the back of the rear transom.

The pad to support the breech of the gun in travelling is fixed to the front of the third transom. It consists of a metal bracket N attached to the transom by two bolts. In this bracket is keyed the spindle of a metal buffer stop L, on which are placed two rings of india-rubber M, M, separated by a parting plate of wrought-iron.

Axletree seats. Fig 1, Plate X.

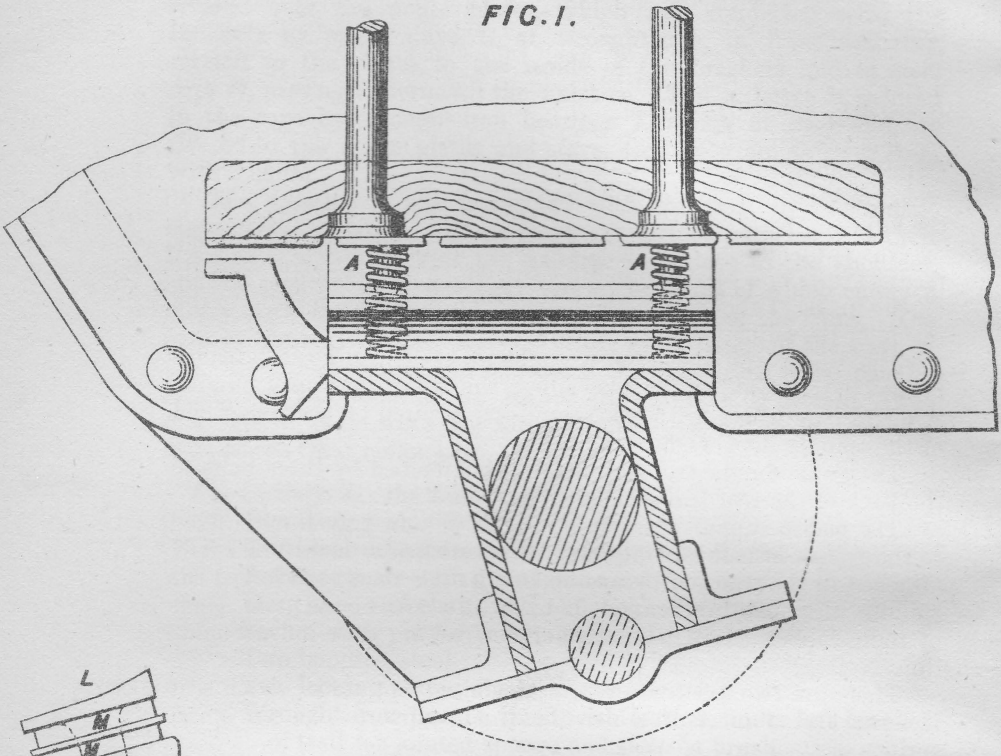
There are two axletree seats, with sliding foot rests. Each seat is formed of a piece of sabicu 1·5″ thick, supported on six spiral springs of steel, No. 11 W.G.

The springs rest on the top plate of the axletree bed, and are coiled round studs of wrought-iron, projecting from the under side of the seat, to which the ends of the springs are also secured by screws.

Guard irons with back straps are fitted to the seats, of a similar pattern to those for the 9-pr. carriage, but 3½″ higher. An additional hand strap, besides that on the advance ring, is attached to the guard iron on the inner sides. The outer standards of the guard irons pass through the top plate of the axletree bed, which at each end is bent, and has a short bent plate riveted over it. The standards are nutted and keyed beneath, by keys attached to them by chains. These standards also pass through iron loops projecting from an iron plate fixed to the underside of each axletree seat. Nib irons project from the inside edges of the seat, and slide in recesses formed in guide plates, fixed to the carriage brackets. The inside standard passes through a wrought-iron socket fixed to the outside of the carriage bracket, and is secured by a split key with chain.

Each foot rest consists of a wrought-iron step, roughened on the top, with gudgeons on each end to which steel side bars are secured by nuts. The side bars slide in slots formed in wrought-iron brackets riveted on the top plate of the axletree bed. The step is secured, when pushed up, by a wrought-iron catch,

FIG. 1.



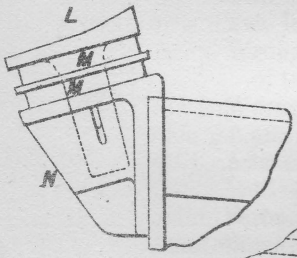
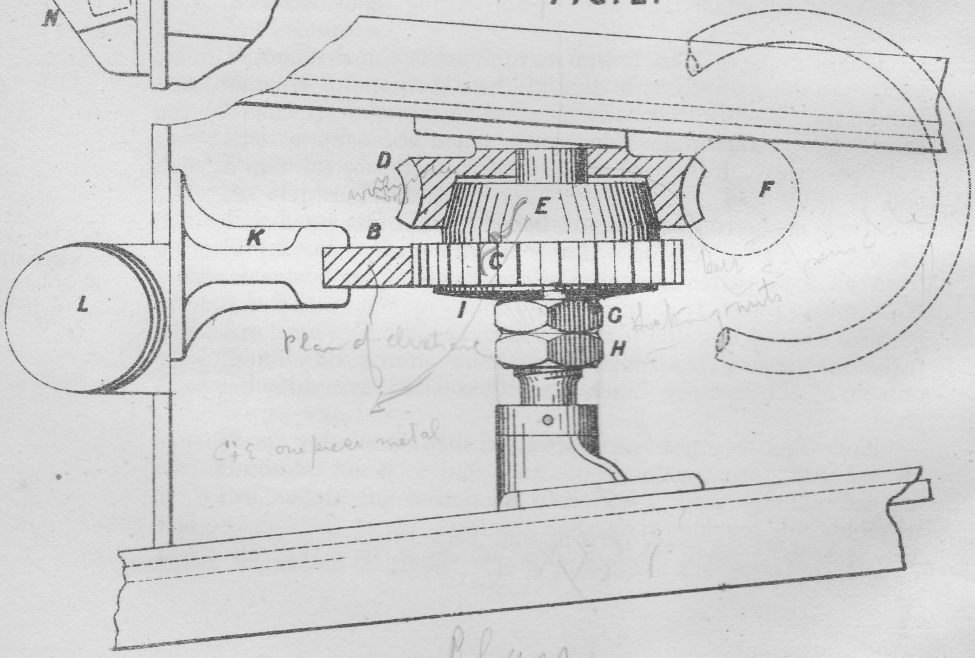




FIG. 2.






DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN.

which pivots on a pin, supported in two brackets riveted on the top plate of the axletree bed, under the seat.

The drag shoe is No. 5, of wrought-iron with steel sole. It weighs 21½ lbs. The chain is ½″ No. 10.

The deflector, when not required for use, is secured out of action by a strap.

The following leather cases are issued with each carriage. Two for cartridges, two for case shot, and one each for fuze pocket, tube pocket, long and short tangent sight, cylinder of time fuzes and priming irons.

Cartridge case. This is a cylindrical case with lid, secured by a leather strap, sewn to the back of the case, which passes over a loop on the centre of the lid, and is attached, when the case is on the carriage, by means of a buckle on its end to a short strap on the wrought-iron band on the trail. A leather band surrounds the exterior of the case, which rests on the upper band on the trail, when the case is in position on the carriage. A leather stop on the back of the case below the band prevents it shifting.

Case for case shot. The case for the case shot is similar, but has no leather band round it; the lid rests on the band on the trail. The strap is sewn to a leather stop on the back. The bottom of the case is strengthened by a bent plate of wrought-iron secured by copper rivets.

Case for time fuzes. Is a cylindrical case with lid, secured by a strap attached to the back of the case, which passes through a loop on the lid, and is made fast to a buckle at the front. There is a loop on each side of the case for the strap, by which it is attached to a staple plate between the brackets of the trail.

Case for tangent sight. This is a leather sheath with rectangular top, formed with a flap to cover the head of the sight. A strap is secured to the sheath, which passes over the top and is buckled to a strap attached to the carriage. There is a loop on the sheath below the strap, through which a strap attached to carriage passes. The cases for the long and short sights are similar, except in the length of the sheath.

Handspike. Is of ash unpainted, is straight and has a square point. It fits into a socket between the brackets of the carriage, and is secured by a pin.

R.C.D. Photo-litho. 19D. The piasaba brush is the same as for the 9-pr. The stave is made in two parts, connected by a folding joint, fitted with a sliding collar of P.B.

The jointed stave of sponge and rammer is similarly fitted.

The wheels used with the carriage are No. 26, pattern B, second class.

## 12-PR. B.L.

Plate XI. This carriage consists of a trail, a removeable axletree, and two field wheels. It is fitted with elevating gear to allow of 16° elevation and 8° depression, and with an automatic break to check recoil

The trail consists of a trough formed by two flanged bracket plates of steel ·192″ thick. Each plate is strengthened by angle steel riveted inside the angle of the upper flange. The bracket plates are connected by two jointing plates of steel riveted beneath

their lower flanges; by two transoms, and by a trail eye. The rivets used for the connection of the different parts of the trail are $\frac{7}{16}''$.

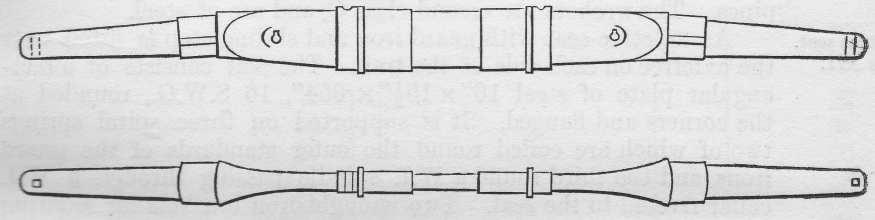
The trail eye is of wrought iron. It is forged with a loop at the front for the hook of the drag chain, and is fitted with a removeable steel. It is riveted over the bracket plates at the point.

A trunnion bracket of cast steel is riveted to the outside of each bracket plate at the front. The trunnion brackets are connected by a front transom of flanged steel plate riveted to them.

The trunnions of the gun are supported in bearings in these brackets and are secured by steel capsquares. The capsquares are hinged on steel joint pins, secured by steel collars and split keys. The capsquare keys are of steel and are attached each by a wrought-iron chain to a screw loop. Two steel plates are riveted across between the bracket plates in rear of the transoms, to form the ends of a trail box, of which the bracket plates form the sides. A lid of steel plate is hinged to a beading of wrought-iron riveted on the upper flange of the left bracket of the trail; it is fitted with a hasp, which is secured, when the lid is closed, by a turnbuckle riveted on a beading on the right bracket. The box is fitted with a block of teak hollowed out to receive two case shot and fitted with two lifting straps. Two cartridges can be carried in the box in a waterproofed canvas cartouch. Trail box.

The axletree (Fig. 7) is of steel, rectangular in cross section. The arms are second class C No. 37 and are formed without collars. Axletree.

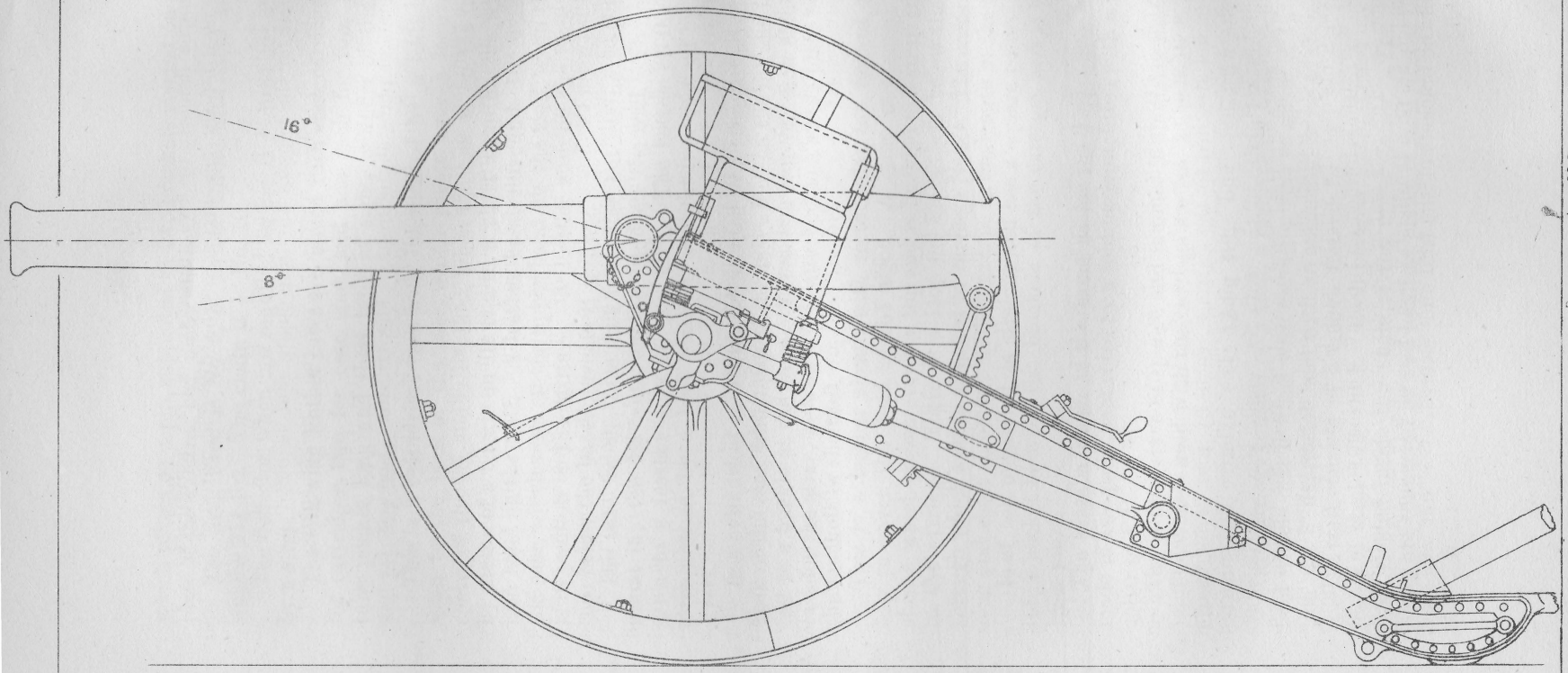
Fig. 7.



The axletree fits with a play of about $\frac{1}{5}''$ in recesses in the trunnion brackets, in which it is secured by two clip plates, passing underneath it and attached to the carriage, each by four wrought-iron ·75″ bolts with nuts and split pins. The axletree is connected with the bracket plates of the trail by tensile stays. The stays are of steel 50·75″ in total length and 1·25″ diameter, formed each in two pieces. The front end of the front piece is formed with a loop, which fits over the axletree, and is secured by a ·35″ taper pin, and by feathers formed on the stay, which fit in key ways in the axletree. The rear end of the rear piece is also formed with a loop, which fits on a tensile stay bolt of steel 1·4″ diameter passing through the brackets of the trail and secured by a nut and key.

Plate XI.

# CARRIAGE, 12 PR. B.L. STEEL.



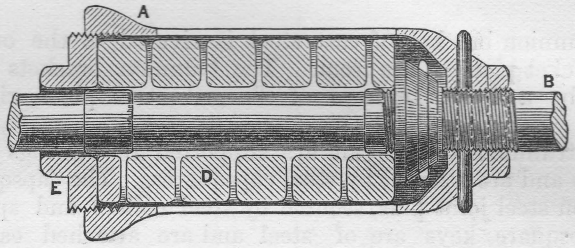

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INCHES 12 9 6 3 0 1 2 3 FEET.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 12456.

The two pieces of the stay are connected by a socket and spring Fig. 8.

Fig. 8.




The socket A is of forged steel 9″ long, 3·9″ external diameter and ·125″ thick. The front end of the rear piece of the stay B is screwed into the rear end of the socket and is secured by a pin. The rear end of the front piece of the stay, enters the socket loosely. A spring D is coiled round the end of the stay that enters the socket, and a nut is screwed on the end of it and secured by a pin. The front end of the socket is closed by a nut E through which the stay passes. The spring consists of 5½ coils, 1·15″ pitch; internal diameter 1·45″, external diameter 3·45″. It is square in section, 1″ each way. The total length is 6·3″, the opening between the coils being not less than ·15″. It should compress ·45″ with a load of five tons without any permanent set.

The arms are C pattern, and take wheels No. 36, with 11″ pipes. The washers are second class C, and are of steel.

Axletree seat. Plate XII.

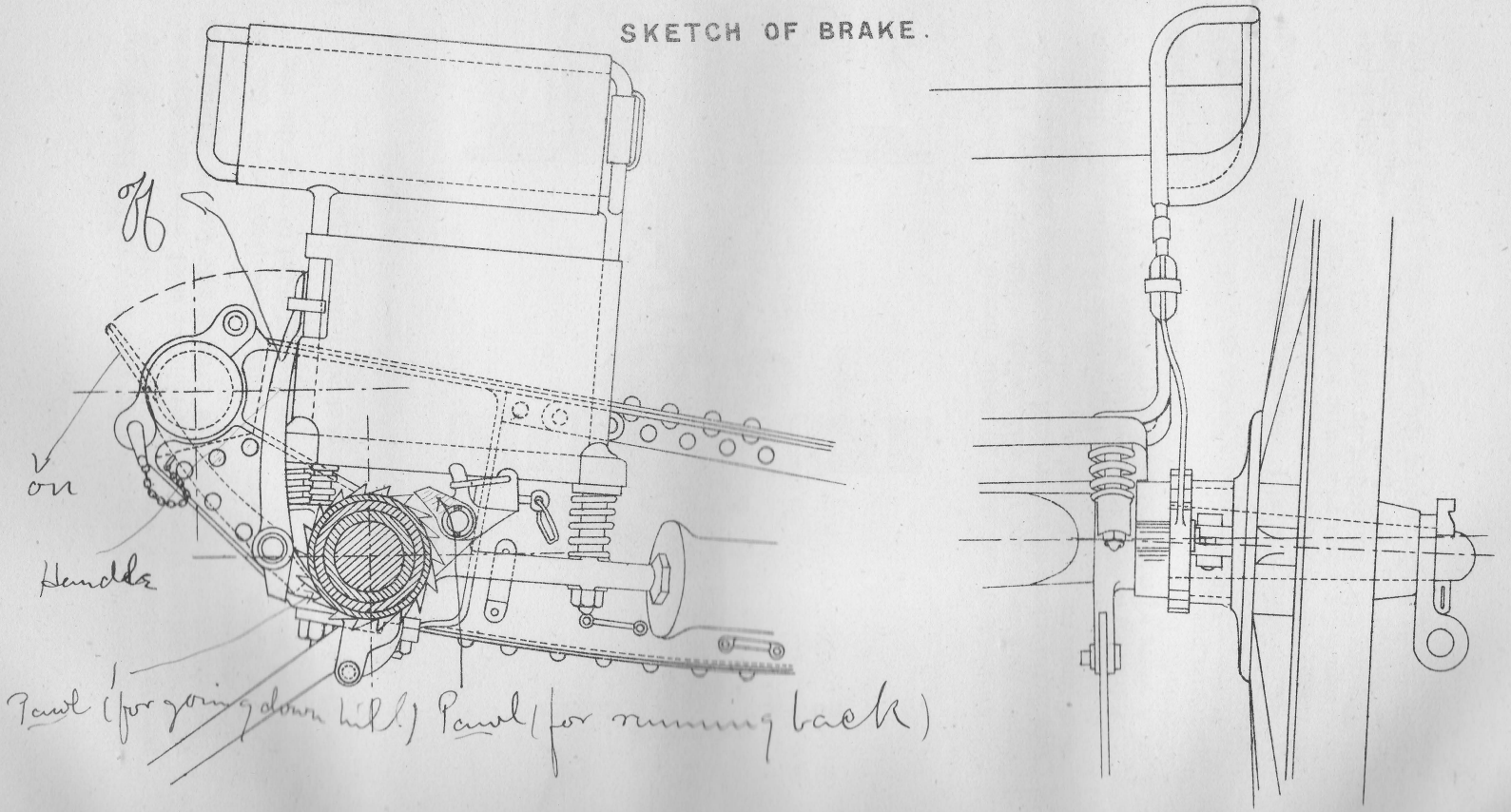
An axletree seat with guard iron and sliding step is fitted over the axletree on each side of the trail. The seat consists of a rectangular plate of steel 16″ × 15½″ × ·064″, 16 S.W.G., rounded at the corners and flanged. It is supported on three spiral springs two of which are coiled round the outer standards of the guard irons, and the third round a W.I. spindle passing through a W.I. collar riveted to the seat. Two wrought-iron brackets for securing each seat are fitted to the axletree. The outer bracket on each side loops over the axletree feathers in the brackets fitting in keyways in the axletree. The inner bracket forms a long fork in which the axletree fits. The bracket is secured by a screw and pin. The front standard is supported in the outer bracket, the spindle in the inner, and the rear standard in a socket formed in the tensile stay. The standards and spindle are secured each by a nut and split key. The standards pass through wrought-iron collars riveted to the seats.

On the inner side of each seat a wrought-iron standard fits in a wrought-iron socket attached to the flange of the trail and is secured by a split key. The sliding step consists of a wrought-iron plate connected by ·375″ rivets to steel side bars, which slide

Plate XII.

# CARRIAGE FIELD B. L. 12 PR MARK I.

## SKETCH OF BRAKE.




DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 12455.

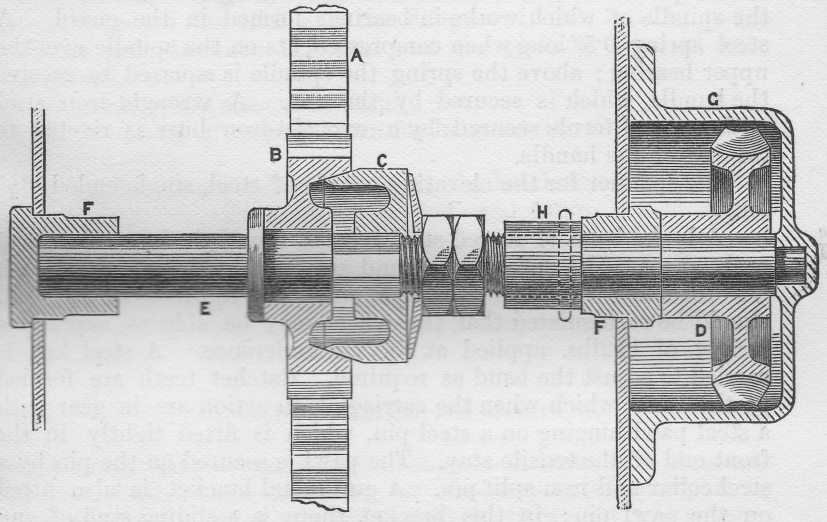
on wrought-iron pins secured by split keys in the brackets supporting the front of the seat.

The springs consist of six coils of steel wire ·25″ diameter. They are intended to stand an extreme safe load of 200lbs. with $1\frac{1}{4}$″ compression.

For R.H.A. Batteries the seats, guard irons, steps, &c., are removed, and a special standard is substituted to carry the ring of the brake lever.

The elevating gear consists of the following parts :— Elevating gear.

Fig. 9.




An arc A of cast steel, 20 teeth, formed in two pieces, connected by a steel joint pin with collar. The pin passes through eyes in the pieces of the arc, and is riveted on to the collar.

A guide for arc of metal.

A pinion, elevating, B, of forged steel, 14 teeth, 3·9″ diameter.

A friction cone C, of gun metal, with a spring and two nuts.

A worm wheel D, 22 teeth, 3·87″ diameter, of metal.

Spindle E for pinion and worm wheel, of steel 1″ diameter, with collar and pin.

Bearings F, F, for spindle, metal, each attached by two ·4375″ bolts.

Spindle worm of steel, 1″ diameter, with collars, nut, and spring.

Handle for spindle of wrought-iron, radius 4″.

Guard G for worm wheel with nut and four ·5″ bolts.

The arc A is connected at its upper end with the gun, it has teeth formed on the back, which gear with the elevating pinion B. It works against the guide, which is bolted to the rear transom.

The elevating pinion fits on the spindle E and is free to revolve round it. It is formed with a conical recess on one face, to receive the friction cone C which fits upon an octagon formed on the spindle, and which can be forced into the recess in the pinion by two nuts, which should be screwed up until the friction is sufficient to support a weight of 150 lbs. acting at the pitch line of the pinion.

The spindle rests in the bearings F, F, attached to the bracket of the trail, it passes through the right bracket, and the end is supported in a bearing formed in the guard G of the worm wheel D. It is secured in its place by the collar H which fits on it at the inside of the right bracket and is connected to it by a pin. The worm wheel D, is formed with two feathers, which fit in keyways in the spindle at the outside of the bracket; it gears with the worm, the spindle of which works in bearings formed in the guard. A steel spring, 0·5″ long when compressed, fits on the spindle over the upper bearing; above the spring, the spindle is squared to receive the handle, which is secured by the nut. A wrought-iron stud with a metal ferule secured by a wrought-iron burr is riveted to the end of the handle.

The spanner for the elevating gear is of steel, single ended, $8\frac{1}{2}$″ long.

The brake Plate XII.

A brake band of forged steel is fitted round the inner flange of each wheel. The ends of the band are connected by a steel bolt ·75″ diameter with a wrought-iron nut. The tightness of the band should be so regulated that the wheel may be able to support a weight of 112lbs. applied at the circumference. A steel key is carried to adjust the band as required. Ratchet teeth are formed on the band, which when the carriage is in action are in gear with a steel pawl hinging on a steel pin, which is fitted tightly in the front end of the tensile stay. The pawl is secured on the pin by a steel collar and iron split pin. A gun metal bracket is also fitted on the pawl pin; in this bracket there is a sliding stud of gun metal, which, when the carriage is in action, is pressed by a spring against the pawl and keeps it engaged with the ratchet teeth of the brake band. The teeth are formed so that the wheel cannot revolve during the recoil of the carriage, but can turn freely in running up. The spring for the stud has 10 coils, 15 S.W.G. The sliding stud has a loop on its rear end, secured by a split key and fitted with a rope handle, by which the stud can be drawn back on limbering up, allowing the pawl to be disengaged from the ratchet teeth, when it is secured out of action by a wrought-iron link, attached to the bracket. To enable the brake to be used in travelling, without releasing the pawl, a wrought-iron lever with end of hardened steel is pivoted on a stud projecting from the tensile stay at the travelling end of the axletree seat. By pressing down the upper end of this lever by hand, the lower end can be made to engage the teeth of the brake band, and thus skid the wheel. While the carriage is in action and during ordinary travelling the upper end of the lever is secured by a wrought-iron ring sliding on the standard of the guard iron.

The key for the nut of the brake band is formed on a steel bar $\frac{5}{8}$″ diameter, bent to a right angle, each part being 5·75″ long.

The carriage has also the following fittings :—

Lifting handles, at end of trail.

Advance loops at front of axletree.

Shoe, handspike, of wrought-iron, secured between the trail brackets by a tap bolt on each side.

Socket for handspike of steel $\frac{1}{4}$″ plate, attached by ·4375″ rivets.

Loop carrying handspike of wrought iron.

A flanged locking plate of $\frac{1}{4}$″ steel is attached by ·4375″ rivets to each side of the trail. Packing plates of steel are placed between the trail and the flanges of the locking plate, and the space between the trail and the plate is filled in with hard wood.

Hooks for drag shoe and chain.

Three staples of wrought-iron for hammer on the left side of the trail, outside.

A leather box which fits between the brackets of trail in rear of trail box, to contain tube pocket and strap, breech brush, spanners, &c.

Staples for strap securing handspike, on left side of trail.

The handspike is of ash unpainted. It is straight, 5′ long, round in section, and shod with a copper ring secured by three ·5″ brass screws.

## 7-Pr. 150-lbs. Carriage for Gold Coast.

This carriage is constructed in such a manner that it can be taken to pieces, when necessary, for the purpose of transport by hand ; no single part of it exceeding 50 lbs. in weight. It consists of two brackets of steel plate connected by three sliding transoms and a trail eye. A single piece of steel is riveted along the upper edge of each bracket from the trunnion bearing to the third transom.

The ends of the brackets fit into sockets formed in the trail eye, they are secured by a steel pin with leather thong.

The transoms are of wrought iron, they are forged with flanges, which slide in recesses formed on the inside of the brackets by pieces of plate and angle iron riveted to them. The second and third transoms are kept in position by a French key which passes through the right hand bracket and the flange of the transom. The keys are attached to the brackets by chains. The front transom cannot be secured until the axletree and legs are in position. The axletree is a square bar of wrought iron with the ends turned down to form the arms, which are special, and are provided with drag washers and linch-pins, each linch-pin being attached to its washer by a chain. The axletree passes through a square hole in each bracket and is secured by a French key passing through the front transom and into the axletree.

When in action, the wheels can be removed and the carriage supported on legs. Each leg is formed of a bent piece of angle iron the ends of which are hinged by pins with split pins to a bracket supporting leg. This bracket consists of two bars, the upper ends of which hook into holes in the bracket of the carriage, one on each side of the trunnion bearings. The bars are connected by a cross-bar, forged with them, and flanged. When in position, a projection on the flange of the front transom, on that side, fits into a slot in the flange of the crossbar. A stud on the bracket of the carriage also enters a hole in the cross-bar.

The legs are kept apart when in the firing position by a securing cross-bar, which is attached to one leg by a staple, and hooks into a staple on the other. It is secured by a leather tie.

In the travelling position, when the carriage is on its wheels, the right leg is folded under the carriage, then the left leg, the cross-bar hooks into a hole in the right bracket of the carriage and is secured by the tie.

Wrought-iron trunnion bearings are riveted to the brackets, the capsquares are of wrought-iron, and are attached to the brackets by rings and chains.

The elevating gear consists of a cross handled elevating screw 1·5″ over the threads, which works into a metal nut riveted to the second transom.

The brackets, transoms, trail eye, legs, &c., are galvanised.

A wrought-iron handle is riveted to each carriage bracket below the trunnion bearing.

The wheels used with the carriage are Special No. 75, 2′ 6″ in diameter.

### ·45″ Gatling Gun Carriage. Mark I.*

·45″ Gatling gun carriage, L. of C., § 3322.

The brackets of this carriage are formed each of a single plate of iron ½″ thick; they are connected by five bolts, two with solid forged shoulders, and three with collars, and by a trail piece.

There is no axletree bed: the axletree is straight on the upper side of the body but curved on the lower, giving a depth of 3½″ at the centre and less at the shoulders, while its width is constant 1½″: it is housed into the brackets and secured to each by a clip plate with bolts. A stay of round iron further strengthens the connexion between each bracket and the axletree.

The trunnion bearings and capsquares are of metal, each of the latter works in a hinged joint, and is secured by a pin with split key.

The elevating arrangement consists of a small screw of the Whitworth pattern, the hand wheel of which is on the left side.

A tee-shaped iron handspike of the Indian pattern, to fold back upon the trail when not required, is fixed upon the point of the latter, and a trail box of sheet iron, secured by a hasp and turnbuckle, formed between the brackets.

A wooden hinged seat is fixed upon the trail, to the rear of the

* For infantry and cavalry machine gun mountings see Appendix H.

elevating screw. A trail handle is riveted at each side of the trail eye.

Upon each side of the axletree a bearing plate is secured by a coupling plate for the support of an axletree box. The boxes are of wood, each to contain one cartridge drum, the back and lid covered with bullet-proof Bessemer steel, and the latter, which opens from the side next the limber, fastened by a hasp and turn-buckle for padlock and fitted with a prop.

The wheels used with the carriage are No. 50, pattern B, third class, 4′ 8″ in diameter.

## Field Limbers.

The same limber is used with the Mark II carriage, 9-pr. and 16-pr. R.M.L., and Mark I carriage, 25-pr. R.M.L. The fittings, with the exception of those of the boxes, are the same in each case.

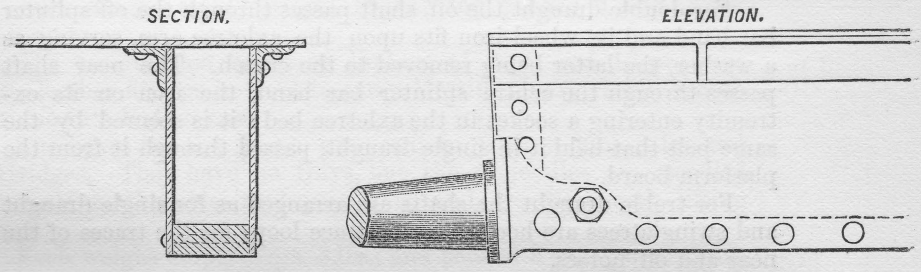
Limber, field 9-pr. Mark II. Plate XIII. § 3201.

The limber is formed of three futchells, a splinter bar with two stays, a platform board, a footboard, a slat, an axletree bed with limber hook, an axletree and wheels, the same as for the gun carriage, and a pair of shafts.

The splinter bar is of plate iron, trough shaped.* It is bolted to the futchells and connected near each extremity by a stay of round iron to the axletree bed: the ends of the bar outside the futchells are filled in with wood.

The axletree bed (Fig. 10) is formed in a similar manner to that of the gun carriage, but being of necessity deeper than the latter to allow of a firm attachment of the limber hook, its sides are con-

Fig. 10.




structed of plate iron, a piece of angle iron being riveted along each for the top plate to rest upon and to be secured to.

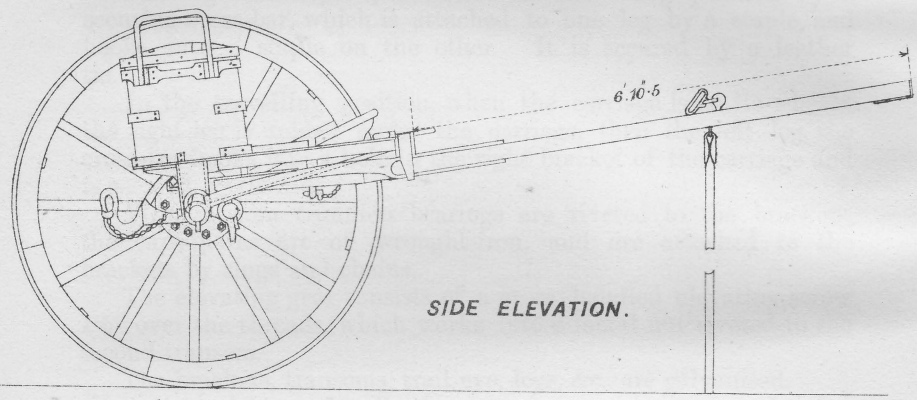
The futchells of tee iron are let into the bed beneath the top plate and riveted to its angle iron; the centre futchell is bent and its end riveted to the back plate of the bed, while the outer futchells project to the rear for the support of the top plate under the limber boxes; the latter plate is also supported by a stay near each end.

The limber hook is forged with three long arms, by which it is riveted to and at the same time held at a sufficient distance from the rear of the bed: the rivets holding the upper arm have collars

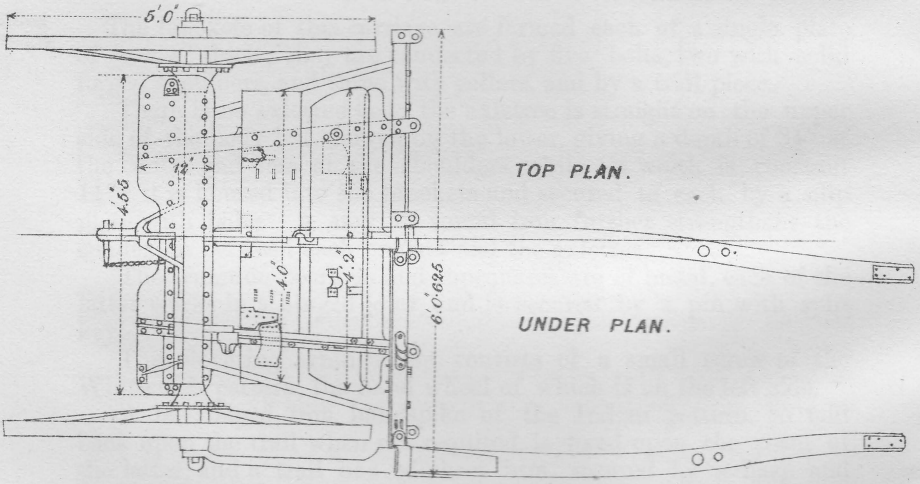
* For future manufacture the splinter bar is to be of steel.

# LIMBER, CARRIAGE & WAGON 9 Pr R.M.L. MARK II.

*Scale about* $\frac{1}{32}$ *nd*




SIDE ELEVATION.




TOP PLAN.

UNDER PLAN.

12447.

DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

on them. It is steeled in a similar manner to the trail eye, and has a key of steel (marked S), which passes through the point to secure the trail of the carriage. All limber hook keys have been placed in a numbered series, the key for this limber being No. 1.

The platform board of ash is 10″, and the footboard of elm 11″ wide, and beneath the front of the latter the slat of ash is secured across the futchells to prevent a horse getting his leg between the splinter bar and the board.

The shafts are the field shafts, "near" and "off:" they are of ash, the off shaft is known as the Brandling pattern, the peculiarity of which is that the part between the splinter bar and axletree arm is of iron (termed the "wheel-iron") and consequently much slighter than if of wood, which allows of more room between itself and the wheel for mud to work through. The near shaft is identical with the near shaft of the wood field limber, but the off shaft differs from the off shaft of the latter in the form of the end of the wheel iron.

The limber is fitted for single, double, or treble draught, as follows:—

Fittings for draught.

For single draught the near shaft passes through the near splinter bar band or shaft iron, its extremity entering a "stirrup iron" bolted to the left futchell and being secured by a bolt, which passes from the footboard through it. The off shaft passes through the V-shaped iron, termed the "Brandling iron" upon the splinter bar, where it is supported by a pin, while the wheel iron upon its extremity fits upon an iron crutch upon the axletree bed and is there secured by a linch-pin.

For double draught the off shaft passes through the off splinter bar band and its wheel-iron fits upon the axletree arm, serving as a washer, the latter being removed to the crutch. The near shaft passes through the centre splinter bar band, the iron on its extremity entering a socket in the axletree bed: it is secured by the same bolt that held it in single draught, passed through it from the platform board.

For treble draught the shafts are arranged as for single draught and swingletrees are hooked to the trace loops for the traces of the near and off horses.

Miscellaneous fittings.

The limber has the following fittings:—For securing the ammunition boxes, which rest upon the futchells and the top plate of the bed, there are upon the back of the axletree bed, two large staples with straps for the off and near boxes, and upon the upper arm of the limber hook a staple with strap for the centre box. Each box is held at the same time by its nib iron entering a box staple in the platform board, where it is retained by a pin. There are also fittings for carrying entrenching tools, grease tin, swingletree, &c.

Articles belonging to.

The articles made in Royal Carriage Department belonging to the limber are three ammunition boxes, "near," "off," and "centre," with a canvas cartouch for the near and for the off box, also a half-round grease tin.

The near and off boxes, which are similar, are of deal with elm

ends, and are strengthened with iron clamps. They are arranged to carry the projectiles and cartridges, and are partitioned in such a manner that the former pack on the outer sides of the latter, and thus protect them. The projectiles stand in trays of beech supported on risers, while their heads fit into blocks on the lid. The lids of the boxes are fitted for small stores, each article being secured by a strap. The centre box is divided by copper partitions to contain fuzes and tubes. Each box is fitted with a nib iron and a staple for strap for its attachment to the limber, and with hand leathers; the off and near boxes each with a folding guard iron and fittings for carrying entrenching tools, &c., and the centre with a shell key. Boxes, ammunition.

The cartouches for the cartridges are waterproofed and the bottom stiffened with millboard; to each is attached a web strap, by which it can be slung on a man's shoulder.

The off and near boxes for the 9-pr. gun contain each 18 projectiles and cartridges.

Beneath the front and rear trays the bottom of the box is hollowed out to admit of four extra projectiles being carried there on emergency.

Under the side trays are carried time fuzes.

Each weighs empty 3 qrs. 21 lbs., and packed 2 cwt. 3 qrs. 12 lbs.

The boxes for the 16-pr. gun contain each 12 projectiles and cartridges. No extra projectiles can be carried. Small blocks of wood are fitted in the front and rear compartment for the purpose of securing the fuze cylinders when carried under the trays. § 3978.

Each weighs empty 3 qrs. 19 lbs., and packed 2 cwt. 3 qrs. 26 lbs.

The ammunition boxes of limbers of 9-pr. and 16-pr. guns have leather fittings in front to carry Martini-Henry carbines, each carbine in a leather case. L. of C. § 3474.

The boxes for the 25-pr. gun contain each 9 projectiles and cartridges. They have no trays, but the projectiles are steadied by cleats on the sides and partitions, and are fitted with lifting straps.

Each weighs empty 3 qrs. 3 lbs., and packed 3 cwt. 0 qrs. 25 lbs.

Centre boxes are of deal with mahogany ends. The canvas cover is extended over the sides and hinge; a recess made in the top edge of the back, from which a hole passes out below the hinge, and a piece of leather is let into the lid so as to press tightly on the lock. Boxes, centre. L. of C., §§ 3024 and 3362.

It has been approved to fit stronger hinges to these boxes. § 4311.

They contain fuzes, tubes, &c.

This limber is used with Mark I carriage 9-pr. and 16-pr. R.M.L., it differs from Mark II in having a wooden axle bed (of elm) with a block at the rear and limber hook similar to that of the old wood carriages. Field limber. Mark I.

The futchells are housed across the bed and secured by bolts passing vertically through the latter and nutted beneath; they do not extend beyond the bed to the rear, but knees are attached to

the block and bed to support the ammunition boxes in a position sufficiently far back. To give rigidity to the frame of the limber, an angle stay is riveted to the futchells along the front of the bed.

The limber hook is secured by three bolts, two of which are nutted at the front of the bed, while the third screws into the end of the centre futchell, which is bent down between the bed and block.

The axle is secured in the axle bed, as in the wooden carriages, by yoke bands with coupling plates, by the V-irons and a clip plate.

The footboard is 11″ wide, the platform 13″; and there is no slat.

The boxes are the same as in Mark II limber.

### 9-pr. R.M.L. Limbers for India.

9-pr. R.M.L. limbers for India.

The limbers for service in India are the same as for home service, but the off and near boxes have fixed looped guard irons, one at each side of each box, instead of a folding guard iron at one side only; they have also a plain staple instead of a handle on the back and front. The loop guard irons are for the purpose of passing a bamboo through, and so carrying the box slung from men's shoulders.

### 7-pr. R.M.L. of 200 lbs. Gun Limber, Colonial Pattern, Mark II.

7-pr. R.M.L. limber, Colonial pattern. L. of C., § 3473.

The limber is similar to that for the 9-pr., the axle bed and shafts being the same as in the ·45 Gatling limber, and taking the same wheels as its own gun carriage. The "off" and "near" boxes are arranged to take each 30 rounds.

### 13-pr. R.M.L. Limber.

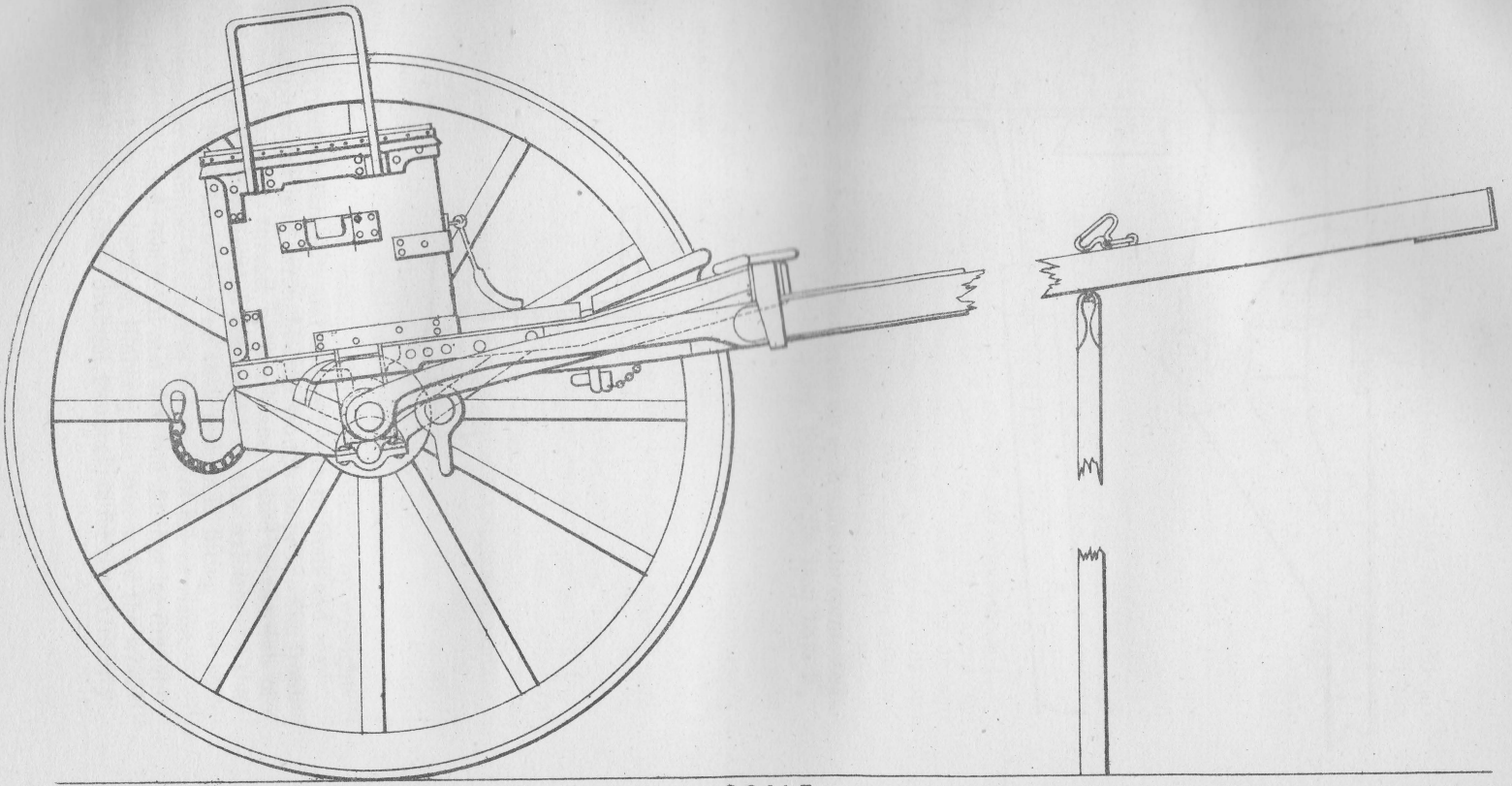
§ 4237. R.C.D. Photo-lithograph 19B. Plate XIV.

The limber consists of an axletree bed with axletree, four futchells, a splinter bar, two tensile stays, a limber hook, a platform board, footboard and slat, and two shafts.

The axletree is interchangeable with that of the carriage. The axletree bed is formed by a wrought-iron frame, having two projections at each end, by which it is riveted to the axletree. The futchells connect the splinter bar with the axletree bed and limber hook. They are of T-iron; bent to form recesses for the axletree bed, which rests on, and is riveted to them.

The limber hook is of wrought-iron. It is formed with four arms, of which the lower are longer than the upper. The upper arms lie inside the two centre futchells, and are riveted to them, the lower arms fit over the axletree, and are riveted to stays of plate iron D, which are themselves at their upper ends riveted to the futchells, and at their lower ends to bearings E, which fit over the axletree, and are riveted to the caps H beneath it. The limber hook is fitted with a moveable steel, and has a steel key similar to that for the 9-pr., but with the arm at right angles to the feather and a shorter chain.

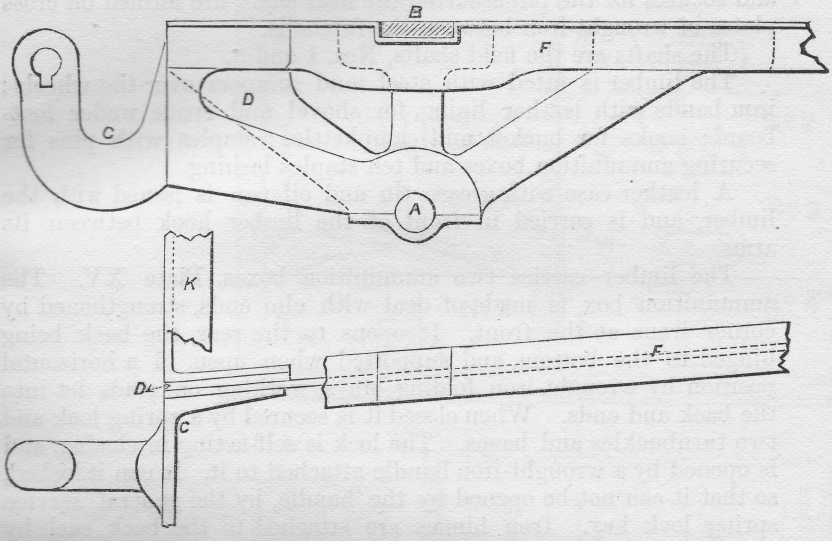
# LIMBER, 13 Pr. R.M.L.




12451.

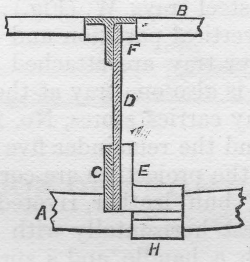
DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN.

Fig. 11.




The rear ends of the centre futchells on each side are connected with the ends of the outer futchells by bent angle iron bars K, riveted to both.

Fig. 12.




The outer futchells are connected to the axletree by wrought-iron stays riveted to futchells and axletree both in front and rear.

The splinter bar is of wrought-iron trough shaped. The front end of each futchell is turned outwards and bolted to the web of the splinter bar which is also connected to the axletree by the tensile stays. These have loops on their rear ends, fitting over the axletree arms, in a similar manner to the stays of the carriage.

The platform board, footboard and slat, and fittings for draught are similar to those on the 9-pr. limbers; the crutch for the wheel iron of the off shaft in single draught, two sockets for the extremity

of the near shaft, when in single or double draught respectively, and sockets for the pin securing the near shaft, are formed on cross plates of wrought-iron between the futchells.

The shafts are the field shafts, Nos. 1 and 3.

The limber is fitted with steel mud scrapers over the wheels; iron bands with leather lining, for shovel and spade under footboard; hooks for bucket and campkettles; staples with pins for securing ammunition boxes and ten staples lashing.

A leather case with grease tin and oil can is issued with the limber, and is carried in front of the limber hook between its arms.

Ammunition boxes, Plate XV. R.C.D. Photo-lithograph, 19E.

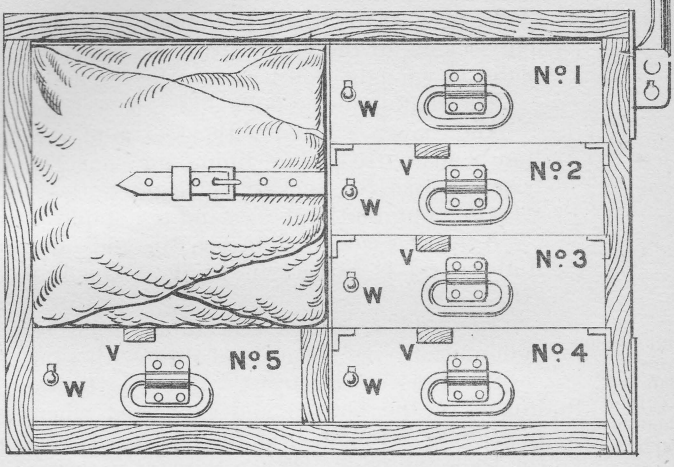
The limber carries two ammunition boxes, Plate XV. The ammunition box is made of deal with elm ends, strengthened by corner irons at the front. It opens to the rear, the back being hinged to the bottom, and supported when open in a horizontal position by wrought-iron folding stays, working on studs let into the back and ends. When closed it is secured by a spring lock and two turnbuckles and hasps. The lock is self-acting in closing, and is opened by a wrought-iron handle attached to it. It can it locked, so that it can not be opened by the handle, by the general service spring lock key. Iron hinges are attached to the back, each by four screws and two copper rivets. The top is covered with canvas, secured by a band of leather tacked on all round. The ends are fitted with folding guard irons, 4″ higher than those for the 9-pr., and handle.

The box is constructed to carry 18 rounds of ammunition, with a proportion of small stores, fuzes and friction tubes. It is divided internally into two compartments by a vertical flanged plate of Atlas steel, riveted to top and bottom. The outer compartment is fitted with four Atlas steel trays W. (Fig.) sliding on angle iron runners, riveted to the vertical partition and to the end of the box (the runners for the lower tray are attached to the bottom of the box by screws). There is also one tray at the bottom of the inner compartment. No. 1 tray carries stores, No. 2 three projectiles and a proportion of stores, and the remainder five projectiles each. The bottom of the trays for the projectiles are corrugated and are fitted each with two strips of buff leather, riveted along the inside, on which the projectiles rest horizontally with their bases outwards. Each tray is fitted with a handle, and a spring catch W, and the upper trays also with a wood batten V, covered with buff to prevent the projectile slipping. The inside ends of the projectile trays are lined with beech. The trays, except the two upper ones, which have special fittings for fuzes and small stores, are identical for each nature of box.

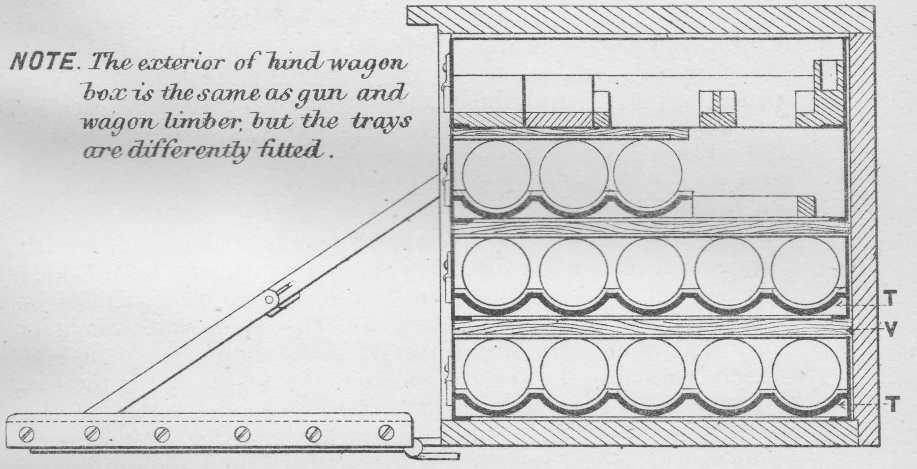
A horizontal steel plate is riveted over the sliding tray in the inner compartment, and is supported at its inner end by a block of mahogany. A cartouch containing eighteen cartridges rests on the plate and fills the remainder of the compartment. It is of canvas, waterproofed on the outside only, the bottom is strengthened with millboard, covered with hessian, and the side and ends are made with flaps to cover the contents. It is fitted with a band 8″ deep to prevent the cartridges falling out.

# BOX FOR GUN AND WAGON LIMBER. AND HIND WAGON, 13 PR. R.M.L.

## FIG. 5.

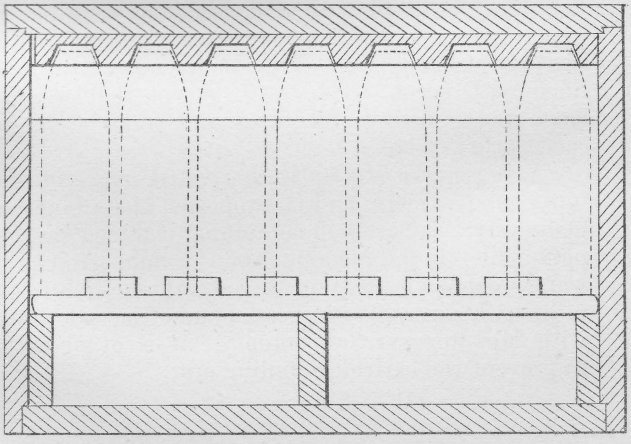



*NOTE. The exterior of hind wagon box is the same as gun and wagon limber, but the trays are differently fitted.*




## SECTION OF FRONT WAGON BOX.

## FIG. 6.



JANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 12453.

Each box is secured to the limber, in front by a nib iron, attached to the box, which enters a box staple in the platform board, and is there secured by a $\frac{3}{4}$″ screwed pin; in rear a clip is forged on each strap hinge of the box, which enters a slot in the angle bar connecting the futchells.

### Limber 12-pr. B.L.

The limber consists of an axletree, limber hook, splinter bar, four futchells, rear connecting plate, platform board, footboard and slat, and two shafts. Plate XVI.

The futchells connect the splinter bar with the axletree and limber hook; together with the rear connecting plate they form a platform on which the boxes rest. Each futchell consists of a flanged plate of steel ·16″ thick, lightened out; the depth of the web being greatest at the axletree and gradually tapered off towards the ends. The flanges of the centre futchells are turned outwards, those of the outer futchells, inwards.

The axletree consists of a weldless steel tube; it passes through the futchells and through flanges of forged steel, which are riveted to the inner futchells and bolted to the outer futchells, by half-inch bolts and rivets. The outer flanges secure the axletree in position, and prevent its turning, a feather on each flange entering a featherway in the axletree.

At the rear the futchells are riveted to a rear connecting plate, of steel, ·16″ thick, flanged and lightened out, the flanges being turned to the front, and the upper flange being level with the upper flanges of the futchells.

The limber hook is of the best re-manufactured scrap iron; it is forged with three arms, the upper of which is riveted to the rear plate, and the other two to the inside of each futchell, by $\frac{1}{2}$″ rivets. The limber hook key is formed so that the handle is turned to the rear, when in position for withdrawing. The hook is fitted with a removeable steel.

The splinter bar is formed by a steel plate $\frac{3}{16}$″ thick, bent to a box girder section 2·5″ each way; it is filled in at the ends with blocks of elm.

The futchells are connected with the splinter bar by clips of steel ·25″ thick, which fit round the bar, and are bolted to their flanges by $\frac{1}{2}$″ bolts. They are also secured, each by one horizontal bolt, which connects clip, bar and futchell. The splinter bar is also connected with the two outer futchells by short stays of wrought-iron, which are riveted to the futchells and bolted to the bar, by ·5″ rivets and bolts.

The futchells are connected by steel angle stays, three between the centre and outer futchells on each side, and two between the centre futchells. Sockets for the near shaft in single and double draught, and for the shaft pins are formed in these stays.

The platform board, footboard and slat are similar to those of the wrought-iron field limbers.

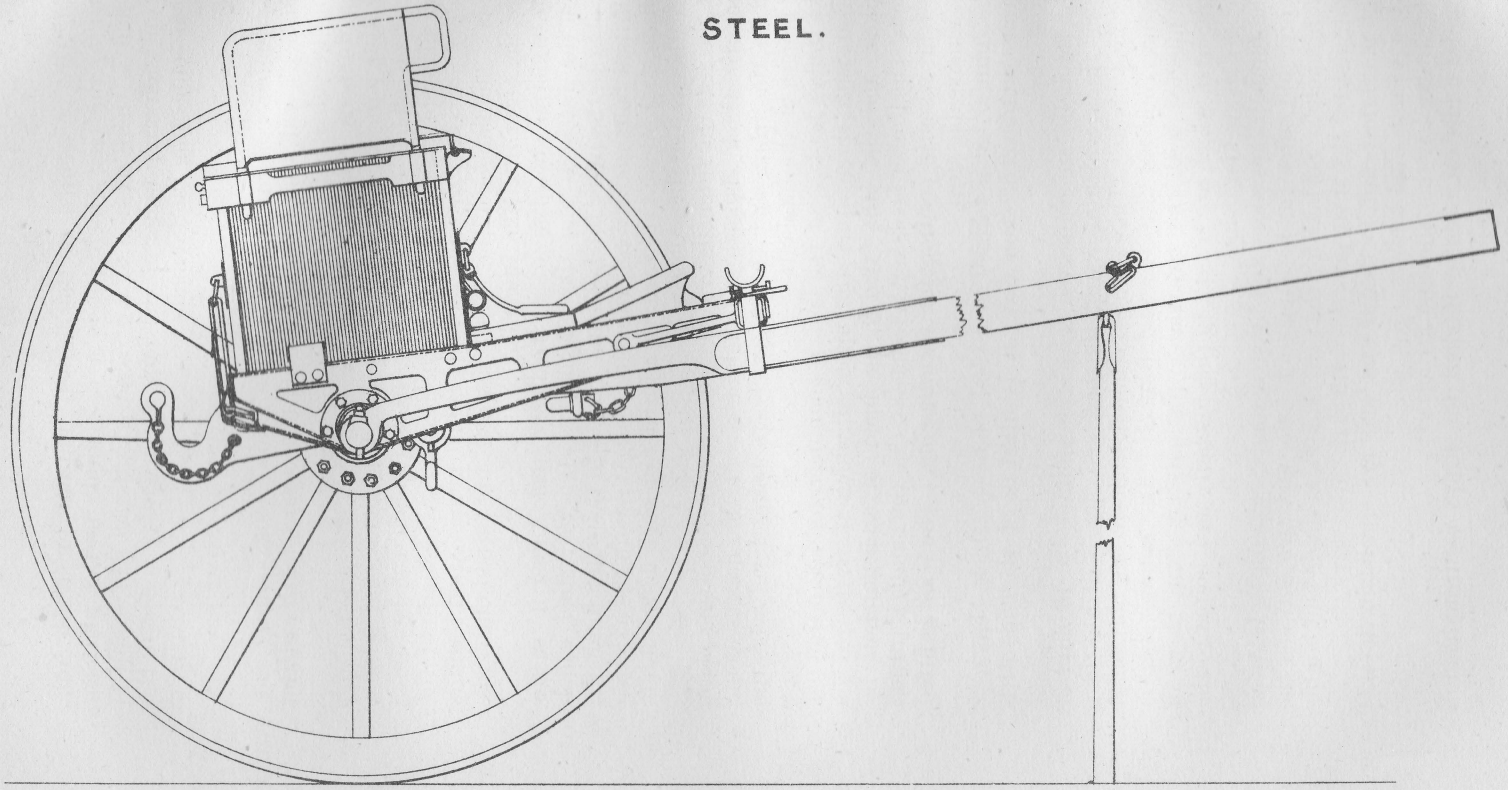
The limber has the following fittings:—

Staples under each centre futchell for straps securing head of

Plate XVI.

# LIMBER FIELD. B. L: 12 Pr. MARK I.

## STEEL.



SCALE.

INCHES 12 9 6 3 0 1 2 3 FEET

DANCERFIELD LITH. &c. BEDFORD ST. COVENT GARDEN. 12465.

pickaxe. The end of the helve is carried in a leather loop buckled to the near centre futchell.

Staple for strap and leather loop on inside of near futchell for brush, water, carriage.

Staple for strap and leather pocket on inside of off futchell for billhook.

On the rear stays, plates for securing a grease tin and oil can, the latter being carried in a leather case.

On the near stay a plate for camp kettle and on the off stay a hook for bucket.

A stay with crutch hook for off shaft in single draught is attached to the two rearmost off stays.

On the splinter bar, two metal brackets with straps for carrying a 6′ common handspike are bolted on the top. The fittings for draught are similar to those of the 9-pr. limber, but are of forged steel. The shafts are No. 1 near, and No. 19 off.

**Boxes, ammunition.**

The boxes are of corrugated steel plate ·04″ thick. The sides and ends are connected by ·187″ copper rivets. The end corner is strengthened by a vertical plate of angle steel riveted to both sides and ends.

A bar of angle steel is riveted round the top of the box and forms a support for the lid.

A wrought-iron band formed with sockets to receive the standards of the guard iron is riveted to the outer end of each box and carried a short way round the corner.

The bottom plate is plain, ·04″ thick; it is flanged all round and riveted to the insides of the sides.

12 Steel studs, the heads of which are 1″ in diameter, were originally riveted to the bottom of the box but are now omitted. The lower surfaces of these were carefully levelled, and on them the box rested.

The box is fitted with handles in front and rear, strong locks, and removeable guard irons, the latter being secured in their sockets by split keys.

The lid is of steel, hinged to the front plate, by wrought-iron hinges. Stops of steel for support of the lid when open are riveted to the front of the box. The lid has a lining of yellow deal attached by ·187″ copper rivets, over which there are strips of felt attached by 1″ screws.

A holdall of leather is attached by screws to the lid. When closed, it is secured by two straps.

The boxes are fitted internally to carry 18 projectiles and cartridges, with a proportion of small stores. The partitions are of steel ·048″ thick, riveted to sides, ends, and bottom. The projectiles are carried standing vertically on beech trays, which are supported on wrought-iron angle riser plates, and are fitted with rings of indiarubber 1″ thick for the projectiles to rest upon.* The latter are steadied in travelling by steel plates, having holes, which fit over their heads. The plates are attached by straps to staples on the inside of the box. Two case shot are carried in each box on the gun limber, the heads of which are fitted with

* These indiarubber rings are now removed.

leather caps. Underneath a double row of projectiles at the outside end of each box, there is a compartment closed by a door hinged to the rear of the box, and secured by a spring turnbuckle. That in the near box is fitted with a tray for friction tube cylinders; that in the off box is unfitted and carries Scott's sight.

A striking board of elm 1″ thick is attached to the box in rear to prevent damage from the trail eye in limbering up.

A hand leather is fitted on the front handle, and when the boxes are in position a third hand leather is attached to a staple on each. The staples for the knapsack straps are arranged so that the knapsacks may be adjusted to admit of access to the compartment underneath the projectiles.

Each box is secured on the limber by two nibs in front, which enter the platform board, and by a nib iron in rear, which is attached to a bushed bracket at the rear of the limber by a screwed pin.

These boxes will in future manufacture be superseded by wood boxes similarly attached, containing the same number of rounds.

As Scott's sight cannot be carried in these boxes, a small wood box, padded inside with horsehair, covered with leather, is fitted for it between the futchells in rear of the axle, on the off side.

### ·45 Gatling Gun Limber. Mark I.

·45 Gatling limber. L. of C., § 3322.

The limber for the Gatling gun carriage is of similar construction to the 9 and 16-pr. limber, Mark II.

The axletree bed is built up of an axletree 2″ wide by 1″ deep, an iron plate on each side of it, and a cast packing piece to complete the top and ends of the box girder; the plates are secured to the axletree and packing piece by through rivets.

The outer futchells are of angle iron, and the centre of tee iron; they are let into the top of the axletree bed, and project to the rear beyond it, for the support of the limber box; a staple for a strap to secure the box is attached to the extremity of each futchell.

The splinter bar is of plate iron, trough shaped, bolted to the ends of the futchells, and supported by a stay near each extremity to the axletree bed.

The platform board is 6″ wide, and the footboard 10″.

The limber hook is of the old form, attached to the bed, without the intervention of a block.

The wheels are the same as those of the gun carriage.

The limber is fitted for single or double draught, with an off and near shaft of the ordinary description for field limbers, but of lighter construction.

Boxes, ammunition.

Two boxes are carried upon the limber; each is protected by Bessemer steel on the lid and back, in the same manner as the axletree boxes, and the lid, which opens from the front, is also fastened in the same manner as the lids of the latter boxes, and fitted with a prop. The boxes are fitted with guard irons of the Indian pattern. They are fitted with false bottoms. The near box carries two drums, one small arm cartridge box, and a proportion of spare parts. The off box carries four drums and a proportion of spare parts; and under the false bottoms of both boxes spare cartridges can be carried if required.

## Ammunition Wagons.

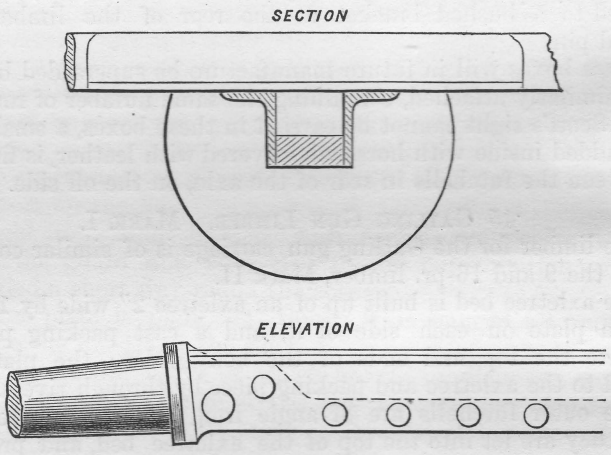
Ammunition wagon, 9-pr. Mark II. Plate XVII. § 3208.

The 9-pr. wagon consists of a perch, two sides, two platform plates, two footboards, three platform boards, an axletree bed, an axletree, and wheels.

The axletree bed is built up in the same manner as that of the gun carriage, namely, by angle iron riveted along each side of the body of the axletree, and a plate over the angle iron pieces.

The perch is formed of two brackets connected by a perch piece with steeled eye and by three collar bolts The perch piece is formed in the same manner as the trail piece of Mark II gun

Fig. 13.




carriage. The brackets are of channel iron, the trough or channel in each being turned outwards, and, in rear of axletree bed, the lower part sloped off. From the point to the position of the front footboard a plate is riveted above and another below the brackets.

The perch lies across the top plate of the bed, each bracket of the former being connected to the latter by a piece of angle iron which is riveted to both as well as by rivets through the channel iron.

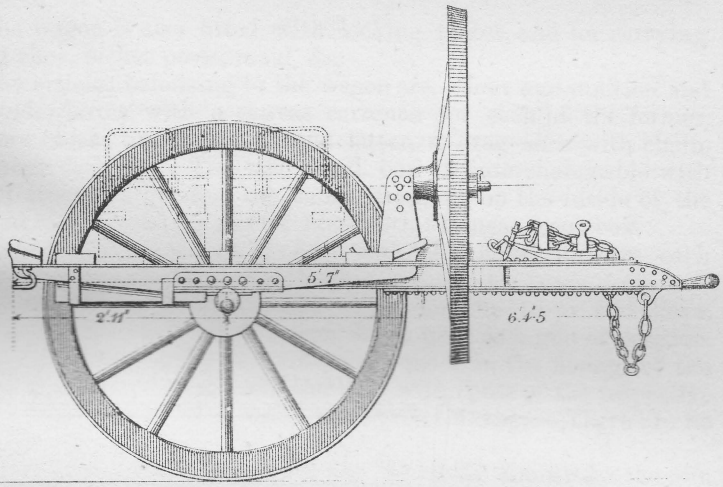
The sides of the wagon are of angle iron, fish-belly shaped; they rest upon the bed to which they are each connected by angle iron. To the outside of each side and to the bed is also riveted a stay of plate iron, which much increases the rigidity of the former.

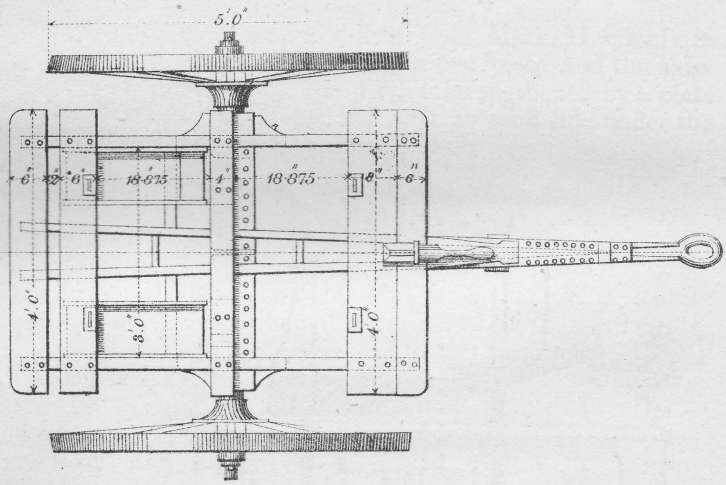
The platform plates are riveted across the perch and the extremities of the sides; they serve to make the structure rigid.

The footboards of elm and platform boards of ash are bolted across the perch and sides; the front and rear platform board lie upon the platform plates; the footboards are raised to the required slope on elm brackets. The space between the front platform board and front footboard is filled in by a piece of wood 2″ wide added to the platform board.

# WAGON, AMMUNITION. 9 Pr R.M.L. MARK II.

*Scale* $\frac{1''}{32}$ = *1 Foot.*






DANGERFIELD, LITH 22, BEDFORD ST COVENT GARDEN.

The wagon has the following fittings:— Fittings.

For securing ammunition boxes, fittings similar to those for the same purpose in the gun limber.

Box irons, &c., for under boxes.

For carrying a spare wheel a block is formed by riveting a plate to the inside of each side of the perch, which projects upwards from the latter through the boards. The plates are connected by two collar bolts, and have an axle arm of wrought-iron riveted between their upper extremities. The wheel is secured by a plain washer and by a linch-pin upon the arm, while it is also steadied and supported by a stay of elm riveted upon the perch.

The wagon is also fitted with locking plates, and for carrying a drag shoe, picket posts, maul, &c.

The articles belonging to the wagon are,—four ammunition and two under boxes, with a canvas cartouch for each of the former, and two grease tins for one of the latter, a drag shoe with chain, and spare lashings. The near hind box is interchangeable with the off front box, having the same strapping on the inside of the lid, and in like manner the off hind with the near front box. Articles belonging to.

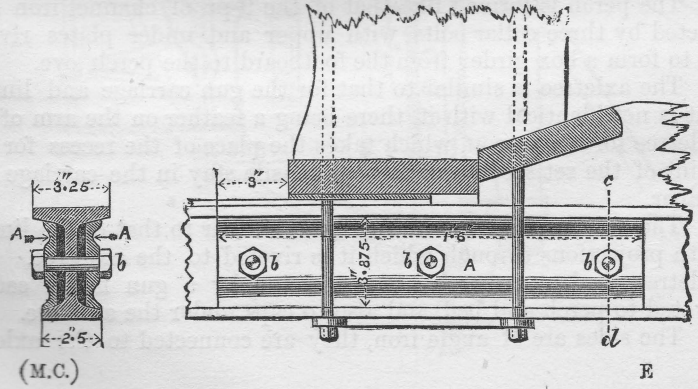
The under boxes are of deal with elm ends, and are each fastened with a hasp and turn buckle.

The ammunition wagon body serves for the 16-pr. and 25-pr. and also for the 40-pr. R.M.L. gun, when used as a gun of position. The only difference for the different guns is in the fittings of the ammunition boxes, which are identical with those of the respective gun limbers, except in some of the leather fittings. There are no centre boxes.

The limber is identical with the Mark II limber for the gun carriage, that used in 40-pr. batteries being the field limber with the same boxes as for the 40-pr. siege limber.

Mark I ammunition wagon differs from Mark II mainly in having the perch formed of girder iron in one piece and the axle-tree bed of wood (ash or elm). The perch is strengthened by a plate (A) of malleable cast iron along the web at each side under the position of the block, secured by three bolts *b*. Ammunition wagon, 9-pr. Mark I.

Section at C. D. Fig. 14. Longitudinal Section.




(M.C.) E

The perch and sides are housed into the bed and secured to the latter by bolts passing through knees riveted to them.

The perch plate is made to clasp the point of the perch as in the old wooden wagon, and a centre plate is riveted along the upper side of the perch for the support of the ammunition boxes.

The block with arm for the spare wheel is of sabicu strengthened by iron.

The boxes, &c., are the same as for Mark II wagon.

The same wagon body serves also for the 16-pr.

The limber is identical with the Mark I limber for the gun carriage.

### 7-PR. 200LBS. AMMUNITION WAGON, COLONIAL PATTERN.

The wagon is constructed to carry two ammunition boxes, it consists of a perch, two sides, a rear end plate, a footboard plate, platform board, footboard, axletree bed, axletree and wheels.

The axletree bed is built up by angle iron riveted along each side of the body of the axletree, and a top plate riveted over the angle irons.

The perch is formed of two brackets of channel iron, connected by a steel perch pin, two collar bolts and a rivet. It lies across the top plate of the axletree bed, and is connected to it by angle iron stays riveted to both.

The sides are of angle iron, they rest on the top plate of the bed and are connected to it by angle iron stays.

The footboard plate is of plate iron, the rear end plate of angle iron. These plates are riveted across the perch and extremities of the sides.

The platform board and footboard are bolted over the perch and sides, the footboard resting on the footboard plates.

The fittings for the ammunition boxes are similar to those on the limber.

### 13-PR. R.M.L. AMMUNITION WAGON.

Plate XVIII. § 4237. R.C.D. photo-litho-graph, 19A.

The wagon consists of a perch, an axletree and bed, two sides with stays, two platform plates, two platform boards and two footboards, and wheels.

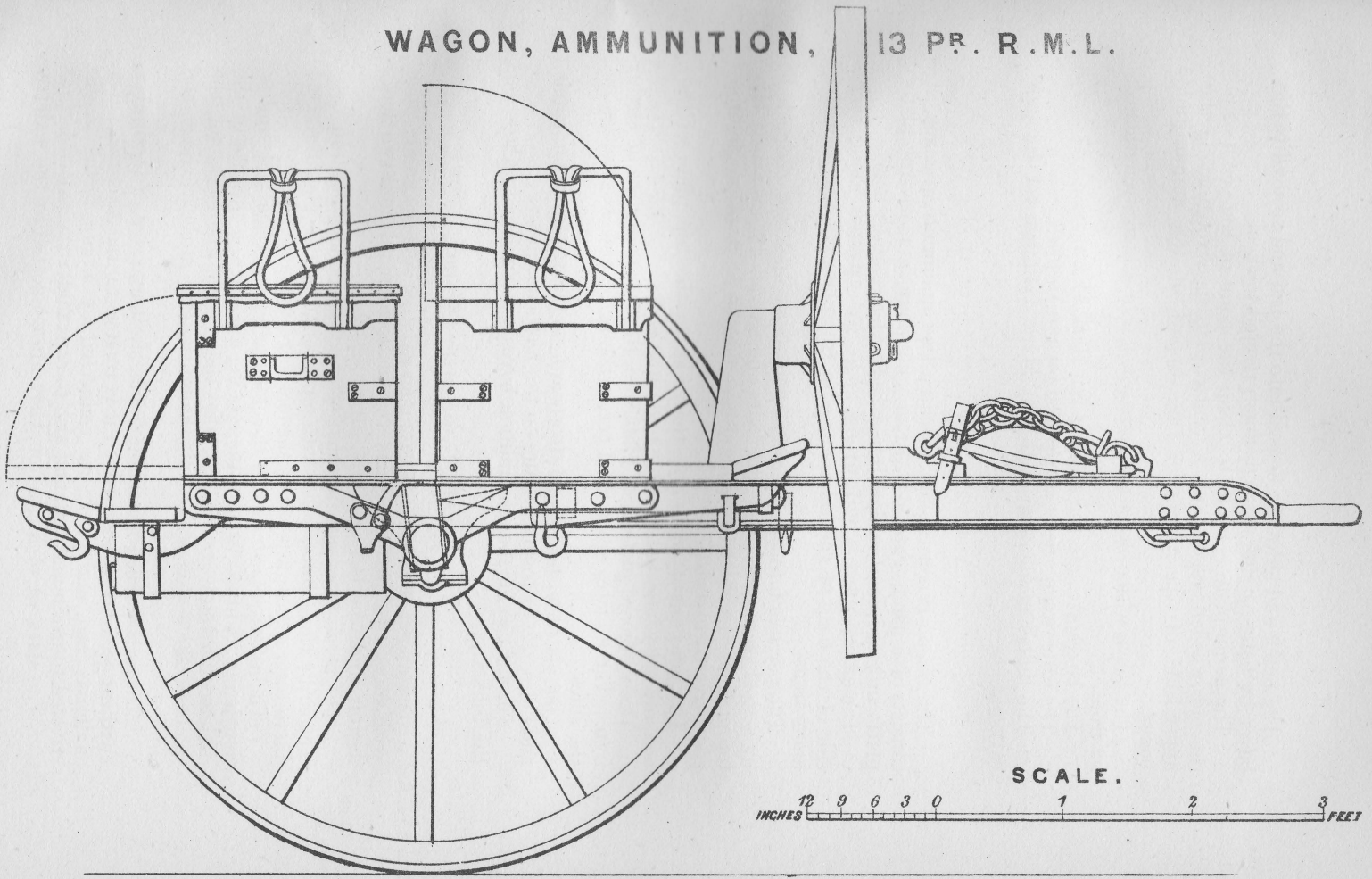
The perch is formed like that of the 9-pr. of channel iron connected by three collar bolts with upper and under plates riveted on to form a box girder from the footboard to the perch eye.

The axletree is similar to that for the gun carriage and limber, but is not identical with it, there being a feather on the arm of the axletree for the wagon, which takes the place of the recess for the point of the set screw securing the tensile stay in the carriage and limber.

The axletree bed is an iron frame, similar to that of the limber, with projections through which it is riveted to the axletree. The axletree, bed, and perch are connected by a gun metal saddle, riveted to perch and bed, and also to caps under the axletree.

The sides are of angle iron, they are connected to the axletree

# WAGON, AMMUNITION, 13 PR. R.M.L.



SCALE.

INCHES 12 9 6 3 0 1 2 3 FEET

12451.

DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN.

by wrought-iron stays riveted to them. Each stay is formed with a loop in the centre, which fits over the axletree arms and enters the flange of the nave. The feather on the arm above mentioned fits in a key way in the stay.

The perch and sides are connected by the platform plates, which are riveted to both, in front and rear of the bed. These plates are lightened out.

The front platform board and footboard are bolted over the perch and sides like those of the 9-pr. wagon. In rear the platform and footboards are bolted to bent plates of angle iron which are riveted to the perch and sides, and project to rear of them.

The wagon is fitted with a wrought-iron arm for the spare wheel, two under boxes; iron loops under the front for pickets, mud scrapers over the wheels, and jack plates.

The wagon carries four ammunition boxes, which stand on the platform plates between the axletree bed and the platform boards. The two hind boxes are like those for the limber, with the exception of some slight differences in the internal fittings of the tray; No. 4 tray being fitted to carry four common shells and one shrapnel, instead of a case shot, and No. 2 box is fitted to take the shrapnel shell only, without fittings for fuzes: they are secured in a similar manner, but the pins, which attach the nib irons on the boxes to staples formed in the axletree bed, are not screwed.

The wagon fore boxes are in general construction, similar to those of the 9-pr., but the guard irons are of increased height. Each box is arranged to carry 17 projectiles in a vertical position, and 17 cartridges in a canvas cartouch. The boxes are secured on the wagon by nib irons and straps.

### Ammunition Wagon 12-pr. B.L.

The wagon consists of a perch, sides, axletree, platform and footboards. It is constructed to carry two ammunition boxes. Plate XIX.

The axletree is interchangeable with that of the limber.

The perch is formed of a steel plate ·128″ thick, bent so as to form a box girder tapering from the rear to the front. At the rear end the lower edges of the plate are riveted to a steel connecting plate. From the position of the wheel arm to the perch eye, the edges of the plate are connected by a lap joint and ·375″ rivets. At the perch eye the section is circular. The eye is of wrought-iron attached by ·5″ collar rivets and fitted with a removeable steel.

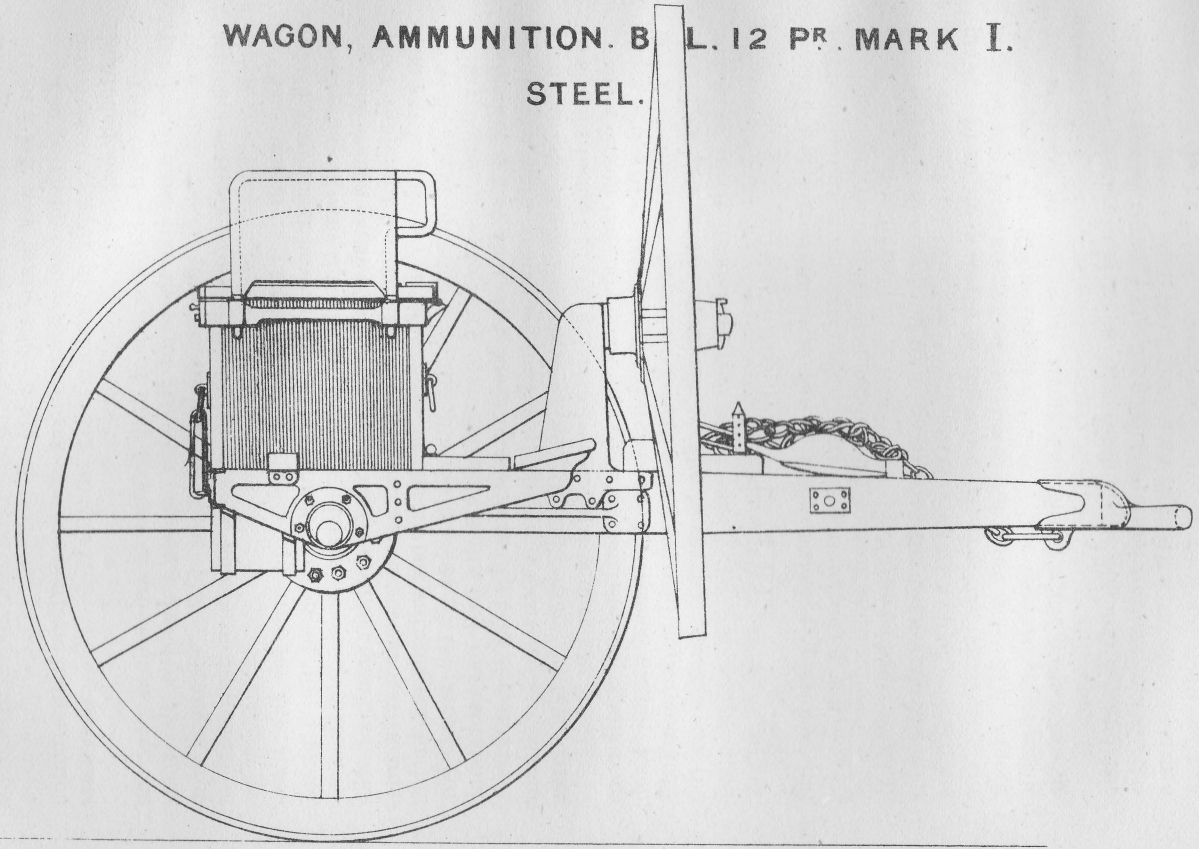
The sides are similar to the futchells of the limber, and the axletree passes through them and is connected to them in a similar manner. The under side of the perch is fitted with steel bearings to receive the axletree. A channel stay of steel filled in with a block of elm is riveted in front of the axletree, between the sides of the box girder forming the perch. The sides are also connected by a collar rivet.

In front of the axletree the perch and the sides of the wagon are connected by two centre stays of flanged steel plate, lightened

Plate XIX

# WAGON, AMMUNITION. B L. 12 PR. MARK I.

## STEEL.



SCALE.

INCHES 12 9 6 3 0 1 2 3 FEET

DANGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN. 12456.

out and partially filled in with blocks of elm. In rear they are riveted to a connecting plate which is joined by angle stays of steel with the centre stays. A block of elm is fitted in the rear end of the perch and is secured by $1\frac{1}{4}$″ screws to this plate.

The centre stays are connected with the perch each by a tensile stay of round steel.

A platform board and footboard are fitted on the perch and sides at the front of the centre stays.

A wheel block with arm for carrying a spare wheel is formed on the perch at the position of the footboard.

The arm is of steel, it is riveted by ·5″ rivets between the upper ends of two steel brackets. Each bracket is formed by a bent steel plate ·16″ thickness, riveted at its lower end by ·375″ rivets to the perch. The brackets are connected in front and rear by steel plates ·128″ thick, attached by ·375″ rivets. An angle plate of steel, ·187″ thick, is attached to the outside of each bracket. The footboard is secured to these plates by ·5″ bolts.

Fittings.

The wagon has the following fittings :—

On the perch—Top : plate staple for ring of drag shoe, staple for strap securing drag shoe.

Sides : steel locking plate, hook for drag shoe, one staple at position of wheel arm, off side, for strap securing leather case for saw.

Centre stay : a leather loop under off side supporting leather case for saw.

Footboard : plates with hooks for camp kettle on each side. Two staples for strap securing picket posts on each side.

There is a box fitted on each side underneath at the rear. The lid opens to rear and is secured by hasp and turnbuckle. The box is fitted to two iron bands by $\frac{3}{4}$″ wood screws one connecting the perch with the side, and the other attached to the rear plate.

The ammunition boxes are of corrugated steel, similar to those of the limber. They will also be superseded by wooden boxes.

## Forge Wagon. Mark I.

Forge wagon. Mark I. L. of C., § 3122.

This forge wagon is the same as the ammunition wagon, Mark I, except that the footboards are laid flat upon the frames with an extra board in front, supported at each side upon a projecting piece of angle iron secured to the footboard.

The anvil rests in a shoe upon the centre of the extra board and front board, the anvil block at the off side of the anvil and the vice box upon the near. A nail anvil is fixed upon the perch. On the near side of the wagon underneath in front there is an iron box for horse shoes and nails, and in rear a wooden box for grease tins. There are no fittings for carrying a spare wheel ; but straps on the front of the body (also on the side boxes of the forge) for securing a box of collarmakers' tools.

A canvas cover and four bale hoops are issued with the wagon.

The wagon limber is the same as the gun limber, but carries only one long box.

## Field Forge. Mark II.

Field forge. Mark II. L. of C., § 3191.

The field forge is formed of a rectangular "frame" of angle iron, supported, when in use, upon four legs also of angle iron, which, when the forge is placed in the wagon, fold beneath the frame.

The "hearth" is of plate iron supported over one end of the frame on collar bolts, it is fitted with a "fender" and with a "back." The fender is simply a narrow piece of plate iron secured by screws round the front of the hearth; the back is also of plate iron, semi-circular in form and hinged to the hearth, so that it can fold down upon the latter or stand erect when it is kept in position by keys. The back is protected from the fire by a "back plate" of cast iron, and has at the reverse side a "nozzle plate" to receive the nozzle of the bellows, from which the blast passes to the hearth, through a hole for the purpose in the back and the back plate.

At the further extremity of the frame from the hearth a "rocking ing staff frame" is hinged for the support of the bellows and rocking staff, the former resting in slots in the sides of the frame, and the latter pivoting on a tee swivel upon the top. An S hook connects the rocking staff to the bellows for use.

Side plates are riveted upon the sides of the frames to support side boxes to carry coal.

The boxes, in addition to a lid, have a small door at the end; each is 49¼″ long, by 15⅝″ deep, and 8″ wide.

The forge frame is fitted with two handles; when placed in the wagon it is secured in front by nib irons, and in rear by straps passed through the handles. Its weight with rocking staff, S hook, and stays is 4 cwts. 1 qr. 2 lbs.

The anvil is of wrought-iron faced with blister steel, the anvil block of elm.

The vice, which for use is fixed upon the splinter bar of the wagon, is that known as the "standing vice for the field forge."

The bellows are of elm, with sides of leather, and nozzle of wrought-iron, they weigh 2 qrs. 21 lbs.

The water trough is of sheet iron with flat hooks upon the side to hang it upon the outside of the fender for use, and upon the bottom to hang it upon the inside for travelling.

Field forge. Mark I.

Mark I forge differs from Mark II chiefly in being slightly heavier.

## Forge Wagon. Mark II.

Forge wagon. Mark II. L. of C., § 3409.

This wagon is the 9 or 16-pr. ammunition wagon, Mark II, modified and adapted for carrying a special forge, artificers' tools, &c., as follows:—

The sides of the body are not connected with the perch by plates, but in rear by a piece of angle, and in front by a piece of flat iron; the frame thus formed is boarded over, sides hinged to it, and the body completed by a movable head and tail board.

This is divided by a cross-sliding partition secured underneath by nuts; a lid hinged to the partition board and secured by hasps covers the rear compartment, and two movable boards, secured by hasps and a flap hinged in the partition, cover the front compartment. The movable boards are intended, off the wagon, to form (with the artificers' tool chest) a wheelers' bench and collarmakers' cutting board (of lime).

In the rear compartment the forge is carried, its legs folded under it, and driving lever removed, secured by a cleat on the right side and by straps to staples on the bottom; light angle irons are fixed on the bottom and tail boards of the wagon to guide the forge as it is pulled in or out, and hinged flaps to prevent it catching against the edge of the tail board. To admit of the forge being worked on the tail board (as well as off the wagon), the latter is covered with plate iron and has chains to secure it in a horizontal position; while to steady the wagon, if at the time unlimbered, props are attached to the perch and to the body in rear. The driving lever is carried strapped to the partition board; the water trough lies on its side inside the forge. A farriers' bag empty, a grindstone in frame and a sledge hammer are also carried in this compartment. In the front compartment the wheeler-fitters and smiths' tool chests are carried. A portable vice is carried on top of the tool chests.

The body of the wagon is covered by a canvas cover on four bale hoops. Beneath the body are four under boxes.

The perch is fitted to carry the anvil and block, a nail anvil is also fixed on it.

A sack of coals, picket ropes, lantern box and valise veterinary stores are carried on the top of the wagon under the bale hoops.

A pit saw is strapped on the off side of the body.

The limber of the wagon is the field limber Mark II, with one large box, which contains soap, dubbing, and some spare iron work. The footboard is fitted to hold the grindstone for use.

The following articles belong to the limber:—

6 tin boxes for dubbing or soft soap (*a*).

1 tin can for paint (*b*).

5 tin cans to hold either 6 quarts of oil or 14 lbs. of paint (*c*).

1 tin can to hold ½ pint turpentine.

(*a*) A rectangular tin box, fitted with two handles at top; in one corner of top there is a hole fitted with screw socket and closed by a metal screw cap.

(*b*) Rectangular tin case with hole in top closed by metal screw cap.

(*c*) A rectangular tin case, with circular opening in top closed by lid with handle. Two handles are also fitted to top of can.

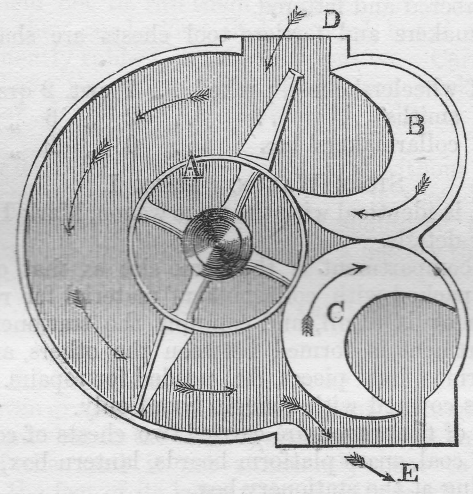
(*d*) A rectangular tin can, with a hole in centre of top closed by metal screw cap. It has also a hole in one corner of the top fitted with a discharge nipple with a brass cap connected to it by a chain.

## Field Forge. Mark III.

Field forge. Mark III. L. of C., § 3476.

This forge consists of a hearth of plate iron, fitted with a fender and back. The fender is of thin plate iron, the front of it bolted to the hearth and the sides hinged. The back is protected from the fire by a back plate of cast iron, and has at the reverse side another iron casting to receive the end of the blast pipe, the back and back plate being cut to transmit the blast to the hearth. The hearth is fitted with four legs of tubular iron, which fold under it when the forge is in the wagon, and are connected by tie rods, when it stands upon them on the ground. To facilitate moving the forge in and out of the wagon, rollers are fitted to the legs and handles to the hearth. A fifth leg with two joints at right angles is added at the back.

Fig. 15.




The blast is given by a Baker's blower. This consists of a metal casing of the form shown in the figure, which represents a vertical section.

In the casing there are three revolving cylinders A, B, C, having spindles formed on their ends, which rest in bearings in the ends of the casing. Two longitudinal fans are fixed to the cylinder A, the outer edge of which, as they revolve pass close to the interior surface of the casing. Each of the cylinders B, C, is formed with a deep groove, as shown in the figure. These grooves are so formed as to just admit the fans passing the cylinders B, C, when all the cylinders are revolving. A copper inlet funnel is fitted to an opening D in the casing, and a copper blast pipe leading to the hearth in an opening E. When the cylinders are made to revolve in the direction of the arrows, the fans carry the air round with them from D, and drive it out through the blast pipe E; the passage for the air back to D being completely closed directly the approaching fan enters the groove in the cylinder C.

Metal spur wheels gearing together are fitted on the spindles of the cylinders at one end.

*On the other end of the spindle of the cylinder A is a bevel pinion, driven by a bevel wheel, the axle of which is cranked, and is connected with a driving lever, with counterweight, by a connecting rod. The blower is fixed on the back of the forge.

The water trough of sheet iron hangs for use on the front of the hearth.

Weight of forge complete, with water trough, poker, and slice, 3 cwts. 0 qrs. 16 lbs.

Tonnage, 0·459 ton.

### Tool Chests.

Tool chests. § 3620. § 3621.

The wheelers and smiths' tool chests are of the same construction and dimensions; they are of deal with elm ends, bound by two strong iron bands, each band having a handle on the upper side. The chests open at one end, each is fitted with four drawers, which are numbered and lettered.

The collarmakers and farriers' tool chests are shallow boxes, each with lid.

| | | | |
|---|---|---|---|
| Weight of wheelers' chest, packed.. | 2 | cwt. 2 | qrs. 17 lbs. |
| „ smiths' .. .. .. | 2 | „ 3 | „ 22 „ |
| „ collarmakers' box .. | 0 | „ 2 | „ 9 „ |

### Store Wagon. Mark I.

Store wagon. Mark I. L. of C., § 3162.

This wagon is identical with the forge wagon, Mark II, excepting in a few minor details.

The front compartment is the same size as that of the forge wagon, and is packed with collarmakers' material for repair. The rear compartment is small, and contains the stationery box. A central compartment is formed between the others, and in it is carried the various iron pieces, &c., needed for repairs. The front compartment is covered with a single board only.

On the top of the wagon are carried two chests of collarmakers' tools, a sack of coal, spare platform boards, lantern box, and a stool for use in writing at the stationery box.

The fittings for stores, &c., are similar to those on the forge wagon, a cross-cut taking the place of a pit saw on the off side.

In the limber box are carried various collarmakers' stores, &c.

The articles belonging to the limber are :—

1 tin box for flour (*a*)
1 tin box for black wax (*b*)
1 tin case ink bottle (*c*)

(*a*) is a plain rectangular tin box with lid.

(*b*) is a rectangular tin box with hinged lid, secured by a clip, holding 1 lb. 9 oz. black wax.

(*c*) is a tin case, pear shaped in cross section, to hold an earthenware bottle.

### Stationery Box.

Stationery box.

This box is of deal, the front opening like a desk for writing upon; its interior is divided into compartments for books, and drawers and pigeon holes for stationery.

Weight of box, empty, 1 cwt. 0 qrs. 0 lbs.

* This driving gear has in some cases been altered to correspond nearly with the gear of the pack saddle forge, page 118.

# SECTION II.

## CHAPTER III.—EXAMINATION AND REPAIR OF FIELD CARRIAGES.

All bearings should be kept clean and slightly oiled, and all nuts tightly screwed up.

Linch-pins, washers, the end of the wheel iron of the off shaft, and axletree arms should be kept perfectly clean, care being taken in cleaning them not to rub them away too much and so reduce them in size; they can be kept slightly oiled, but if so the old oil must be frequently rubbed off and fresh put on. Carriages kept in store should have the bright parts of the iron work coated with grease. Water should not be allowed to lodge in any of their recesses.

Defects or damages should be made good without delay, and if the paint becomes rubbed off at any part, it should be patched over as soon as possible. Opportunity should be taken of the annual painting to give the carriages of a battery thorough overhauling and repair.

### Iron and Steel Carriages.

*Trail.*

Gun carriage.

Trails are liable to become twisted near the point in travelling over very uneven ground, but may be sufficiently straightened for use by placing a crowbar in the trail eye, and forcing it in the required direction. If the trail is not sufficiently bent to prevent its limbering up, the fact of its being twisted a little will be very little detriment to it, and it will be better to leave it so than to run the risk of doing further damage, and perhaps render it totally unserviceable for the time being, particularly if there is any appearance of a fracture. In very frosty weather it would be advisable to warm the trail a little—just as hot as can be borne by the hand. It could be readily warmed over a wood fire on the ground.

In the case of a trail being broken or pierced with a shot, it can be strongly repaired by fish plating.

*Trail Eyes.*

Trail eyes are steeled with moveable steels, and as soon as they are worn through they must be knocked out and new steels put in

One of these steels can be replaced in a few minutes.

Spare steels are carried in the store wagon.

*Elevating Screws.*

Whitworth elevating gear.

Elevating screws should be kept clean and oiled, if they do not run up and down freely, they should be removed and examined, if the threads are indented on the edges, they must be neatly filed

down. If the bevel pinions in the box have become indented, or choked up with clotted oil and dirt, the box should be opened, the necessary adjustments made, and the inside of the box painted with red lead.

The spindle of the elevating wheels may acquire too much play from being worn at the bearings, or the bearing may be enlarged; the spindle may also be bent or broken (especially if made of iron); in such a case it should be taken out of the carriage and a new spindle made of steel. The Atlas steel $1\frac{1}{4}''$ square carried in the centre of the store wagon body is suitable for the purpose.

The spindles must be kept clean and oiled.

*Trail Handles.*

In Mark I carriages, if it is necessary to replace a broken trail handle by a new one, it is best to remove both handles, and allow the rivets to pass through both brackets and include both handles, as there is not room to put separate rivets in after the brackets have been secured together.

*Sponge Loops.*

Sponge loops are liable to break or to be knocked off the trail. There is no difficulty in repairing and replacing them; the rivets should be inserted hot from underneath. The top ends are countersunk.

*Tensile Stays.*

In case of a rivet head breaking off, the stay must be removed, and a piece welded on to form a new rivet head; if a stay is broken at any short distance from the shoulder at either end it can readily be welded, but if broken close to the shoulder a new end must be made.

*Capsquares.*

The inside of the capsquares and the trunnion bearings must be kept clean and oiled. In case of a lug being broken off a capsquare, a new one must be put in.

Spare lugs are carried in the forge wagon limber.

The lugs and the crown of the capsquare are liable to be "drawn," giving too much play to the trunnions of the gun. The capsquare should be repaired as soon as possible, as the deformation otherwise will rapidly increase in firing, and the lugs will be broken.

*Bolts.*

All bolts should be kept tightly nutted up. Sometimes a particular nut will work loose continually; in such cases, after tightening it up, cut the thread of the bolt across close up to the nut and calk it under a little.

If the thread is slightly damaged, the dies should be run over it, but if the thread is stripped off a new bolt will be required.

*Nuts.*

If the thread of a nut is stripped, a new one must be made.

*Rivets.*

Rivet heads may fly off, or they may work loose, when new ones should be put in. Rivets should be examined occasionally to ascertain if they are loose.

*Pins, Keys and Collars.*

Damaged pins, keys and collars can frequently be made serviceable by small adjustments, though new ones may be required to be made occasionally.

Capsquare keys should be kept clean and oiled.

## 13-PR. R.M.L. CARRIAGE.

*Elevating Gear.*

The bearings of the spindle and worm shaft, and teeth of worm wheel must be kept clean and oiled. The elevating arc and teeth in pinion must be kept clean and slightly oiled.

One of the most important points to attend to in the care of this gear, is the proper lubrication of the collars formed on the worm spindle, which take the endlong thrust and between which and the faces of the metal bearings for the spindle there is considerable friction in working.

The friction cone must be kept clean, but must not be oiled.

Friction cones are ground in and have accurately fitting surfaces, hence a file must never be used in cleaning them, and they must not be burnished.

In case of a worm shaft sticking fast, or working heavily, clean and oil the worm collars on the shaft, and teeth of worm wheel; clean the teeth of arc and pinion, and oil all the bearings. Burrs on any part of the gear which would interfere with its motion, must be neatly removed with a smooth file. See that the bolts securing the bearings of spindle and worm shaft are tightly screwed. Should the gear still work heavily, remove all the gear from the carriage. Examine the worm shaft and spindle, and should either be found to be bent, it can be straightened on the anvil at a "blackheat," care being taken not to damage the thread of the worm.

Free all frictional surfaces in bearings, spindle, worm shaft, pinion wheel, arc, and guide from dirt and burrs.

Examine the elevating arc, and if it is found to be bent, it can be straightened on the anvil at a "blackheat."

*Pinions and Elevating Arcs.*

In the case of a tooth breaking out of a pinion or arc a new one of wrought-iron can be made and dovetailed in.

*Feathers and Featherways.*

Burrs on feathers will prevent their entering the featherways and must be neatly cleaned off with a file.

*Drag Chains.*

It is important that drag chains are taken up to the proper length, so that the wheel rides fairly in the shoe. If the chain is

too long, the eye of the shoe will soon become worn away. As there is no ring in the present pattern chain to receive the Q, the link most suitable should be painted a different colour to the remainder of the chain for ready identification.

If the bearing part of a link be worn over $\frac{1}{20}''$ in one direction of sectional diameter, it should be regarded as not perfectly safe. A carriage smith should have no difficulty in replacing a worn or broken link, but great care should be taken in welding up the new link not to burn the iron. If circumstances admit it is desirable that drag chains in constant use should be annealed every two or three years. The chain should be put in a field oven, and raised to a dull red heat, just sufficient not to cause the iron to scale. It should then be allowed to cool very gradually.

*Drag Shoes.*

Care should be taken that as soon as the steel soles of the drag shoes are worn through they are replaced by new ones; spare soles are issued for this purpose. If the shoe is allowed to become worn through in the body it cannot be repaired, and it would take a long time to make a new one.

*Movable Steels.*

Limbers.

Movable steels are now made for limber hooks, and spare steels are issued for the purpose of replacing those in such hooks as have been previously prepared for them.

Care must be taken not to allow the hooks to be worn beyond the thickness of the steels before replacing them.

*Splinter Bars and Futchells.*

Splinter bars have been broken in various places and from various causes, but in the case of the 9-pr. and 16-pr. they generally break through the bolt holes at the junction of the futchells with the bar and draught loop.

When a splinter bar is broken at any point clear of the futchells, it can be strongly repaired by riveting a piece of plate iron along the top and bottom sides of the bar on the inside.

When a spinter bar is broken at the junction of the futchells it will generally be found that the end of the futchell is also broken off at the same place. It can be efficiently repaired by riveting a stay inside the bar to take both the futchell and splinter bar. Also substitute for the present draught loop* one which extends along the splinter bar as well as along the futchell.

*Box-staples.*

The box-staples in the platform board should be examined occasionally, as they are liable to work loose and the screws drop out. Plugging the old screw holes and putting in new screws will generally suffice; but if the board is damaged a new one should be put in. This is very important, as serious accidents may occur from the ammunition boxes falling off.

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* Except for the 13-pr., which does not require the loop on the plate.

*Limber Hook Keys.*

In case of one of these keys bending, it should be straightened at once. Should either of the feathers be broken off, a new one of iron should be welded in.

*Perch Plate Eye.*

The perch plate eye is subject to be worn, and may be re-steeled in a similar manner to the trail eye. Ammunition wagon.

*Perch.*

The perch, particularly in Mark I wagon, is liable to become twisted by the wagon body being thrown on one side without the limber, it can be straightened without taking it out of the wagon.

*Broken Side.*

A side being broken can be strongly repaired by riveting an iron plate vertically over each side of the fracture.

*Platform Boards.*

The platform boards should be kept tightly bolted down, and the box staples for nib irons of ammunition boxes kept firmly secured.

*Loop Plate, Drag Chain.*

The loop plate for the attachment of the drag chain, being broken at the ends, can be repaired; but if the loop is broken it will be necessary to make a new one. The perch must be turned over to rivet it on.

*Bolts.*

All bolts should be kept tightly nutted up.

## Wood Carriages.

The defects to be looked for in the woodwork are shrinkage, cracks, decay, worm, and general damage. General defects.

Shrinkage and cracks are due to exposure to the sun, or from being kept long in a very dry store. The first-mentioned defect makes itself apparent by looseness of fitting of the parts or of the ironwork on the wood.

Decay is usually due to the penetration of moisture under the ironwork or in joinings; it is detected by using a hammer and pricker, as mentioned under the head of "examination of wheels."

Worm, if the carriages have been kept long in a dry store, is to be looked for in parts made of ash, and makes itself apparent by small pin holes, and white dust upon the surface.

With regard to the gun carriage, the trail should be closely examined at each side just behind the brackets, to see if there is any indication of splitting. If there is, the brackets must be removed, and the extent of the splitting ascertained, when it will generally be found that the cracks due to the concussion of firing have started from the housing of the trail over the axletree bed, and continued through the horizontal bolt holes. If not extensive, the The gun carriage.

splitting may be remedied by two bolts through the trail from the upper side, and nutted beneath. If the trail is much split it must be condemned, and as a consequence the whole carriage, for, as a rule, in wooden carriages, which are obsolete for future manufacture, when the cost of repair would exceed one-third of the original value, the carriages are condemned.

Extensive decay or damage in the trail will condemn it, but small damaged or decayed patches may be cut out and replaced by sound timber.

Shakes or cracks along the upper surface of the trail are not of consequence, but should be filled in, if small, by "stopping," the crack being first cleaned out and painted to make the stopping adhere. Large cracks must be filled in with wood of the same kind as the trail itself, the slips being painted and driven in while the paint on them is wet, and then secured by brads; when the paint on the slips is dry, stopping should be filled in to any remaining crevice. Very small cracks can be filled in with putty, being first painted over.

The brackets of the gun carriage are liable to work loose from firing, particularly at the screw holes in rear. If loose they should be removed, the axletree bed of necessity first, the joining surfaces painted, the old screw holes plugged up and new ones bored, and then replaced, the bolts and screws being well tightened. As a rule, decay or other damage in a bracket, unless small, will condemn it, in which case the old ironwork, if serviceable, should be used on the new bracket.

In replacing brackets care must be taken to keep the axis of the trunnion holes at right angles to the axis of the trail, namely by getting a corresponding point at each trunnion hole equidistant from a point taken on the centre of the trail in rear of the elevating screw hole, and also, the wheels standing on the level, the trunnion holes should be levelled across.

The axletree bed should always be removed in making a thorough examination of a gun carriage, the axle being first taken out of the groove. If the bed is much decayed, split (which it is liable to be from the careless use of the jack as well as from firing), or shrunk, it must be condemned and replaced by a new one. Small shakes do not signify, if but slightly shrunk, shortening the axletree bands by upsetting them will be sufficient to tighten the bed in its position.

If the axletree, from the shrinkage of the bed and consequent increase in the depth of the groove, is not properly gripped, the under side of the bed may be planed down a little, and the axletree bands upset to correspond. Another and more expeditious way of remedying this defect is to pack a piece of painted canvas in the groove under the axletree, the groove being first whiteleaded. In replacing an axletree care must be taken to put it in with the "lead" to the front, and to get it at right angles to the axis of the trail by making the points of the arms equidistant from the trail eye.

In all repairs wherever two surfaces are brought into contact they must be painted with red or white lead or ordinary paint.

*The Limber.*

If there is any appearance of decay on examining the limber about the futchells, the boards should be removed and the former examined underneath. The axletree bed is dealt with as the bed of the gun carriage. The block is liable to be shrunk from the bed, and if so, it must be refitted, and the bolts tightened up.

*Splinter Bar.*

A broken splinter bar may be repaired by riveting a plate of iron placed horizontally at the top and bottom of the bar, extending about 6″ each way beyond the fracture.

AMMUNITION WAGON.

*Perch.*

The perch may be broken by a shot, or by the wagon upsetting without the limber, and can be repaired by placing an iron plate vertically on each side and riveting them through.

*Sides.*

A broken side may be repaired by securing an iron plate over the fracture with screws.

*Fluted Boards.*

Fluted boards require to be replaced occasionally; sometimes they can be repaired when split by putting in a few screws, or by screwing an iron plate under the fracture. The grooves should be kept clear to prevent water from lodging under the ammunition boxes.

*Ammunition Boxes.*

The guard irons may require to be straightened occasionally, also to be fitted with new keys. The keys should be kept clean and oiled.

The canvas covers can sometimes be repaired by sewing and patching, but if beyond repair, a new cover must be put on. The boxes must be kept waterproof.

The binding on the lids must be kept tightly secured.

The corner plates, staple plates, &c., must be kept properly secured. Sometimes it is necessary to plug up the old screw holes and put in new screws.

The box locks should work freely. The plate on the lid may require adjustment to enable the box to lock easily. If the spring of a lock is broken a new lock must be put in.

*Internal Fittings.*

The blocks on the lids may foul the projectiles and require to be eased with a gouge, or they may be split, when they can be temporarily repaired by putting in screws. The trays for the projectiles are liable to have the parts which form the concavities chipped off, and when they are much injured new trays should be put in.

*13-pr. Boxes.*

If the corners of the steel trays are burst out, rivet a small corner plate on the inside of sheet brass or iron.

If the latches on the trays do not work well, clean and oil them, also the end of the runner where the bolt strikes, and make any adjustments that are required. Any rivets which have given way must be replaced.

Should any of the rivets in the runners give way, they can be replaced by removing the trays and the cartridge cartouch.

The clips under the rear of the box may become closed up when the box is off the limber or wagon, and should be carefully opened without breaking them. If broken, it will be necessary to put on a new hinge.

The hasps, hinges, and turnbuckles must be kept oiled a little.

*The Locks.*

The bolts in these locks, being of steel, may become rusty, and fail to work properly, when it will be necessary to remove the lock from the box, take the plate off it, and clean and oil the bolts.

If the mainspring of a lock is broken, remove the lock and put in a new one.

*Horse-shoe Boxes.*

The lids of horse-shoe boxes are very liable to split, when they can be strongly repaired by placing an iron band across them.

SIDE ARMS.

*Staves.*

Staves are liable to oecome splintered, when they should be neatly smoothed off, to prevent the splints running into the gunner's hands. A broken stave can be repaired by splicing.

WAGON AMMUNITION AND STORE, R.A.

All the bolts about the wagon must be kept tightly nutted up to follow the shrinkage of the wood.

The wood blocks on the axletrees must give a clearance of 1″ between the fore wheels and the body locking plate.

The main pin and friction-plates should be kept clear of clotted oil and dirt, and kept slightly greased.

All the repairs about the wagon are of a simple character.

SHAFTS.

Are liable to be broken from various causes, and may be spliced in cases of emergency. They should be plated with iron over the junction and riveted through. They are very apt to become rough and splintered near the points and rub the horse's shoulders; in this case they should be nicely smoothed off with the spoke shave and file.

The shafts are liable to acquire too much play and should be corrected in such a manner as will not interfere with their being interchangeable.

In the case of a shaft warping, it should be placed in water and over a fire alternately to make it pliable, and then weighted for a couple of days to give it the proper set.

A broken shaft can generally be repaired by putting in a few screws (if the fracture is not very short) and binding tightly round it strips of copper or raw hide. Jointing a broken shaft by scarfing should be avoided if possible, except in putting on a new piece, as it shortens the shaft.

When carriages are not kept under cover, or when they stand under a shed and the shafts are exposed, the latter should not be allowed to rest upon the ground, but upon the props or upon stones, to keep the points out of the wet.

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## CHAPTER IV.—MISCELLANEOUS ARTICLES.

Apron cloak. § 3999.

This is a leather apron intended for supply to batteries of R.H.A., to protect the cloaks, when packed on the limbers. It is 2′ 6·7″ long and 1′ 8″ wide, it is fitted with four leather loops, through which securing straps are passed.

The cloak folded to a convenient size is placed inside the apron and secured by straps passed through the loops in it and the staples on the rear of the ammunition box.

Boxes, cartridge.

These are rectangular boxes of tin with hinged lids, each fitted with a ring to serve as a handle. Each carries a cartridge. They fit in the axletree boxes of the travelling carriages, or, in the case of the 7-pr. 150 lbs. Gold Coast carriage, in the trail box. The 9, 16, and 25-pr. boxes are fitted internally each with a strap, to facilitate removal of the cartridge.

Boxes, fuze.

These boxes have been arranged in the following numbered series:—

No. 1. Percussion, plain for 20; R.B.L. 20, 12 or 9-pr.

No. 2. Percussion, R.L., for 18; R.M.L. 13-pr.

No. 3. Percussion, R.L., for 16; R.B.L. 40-pr. R.M.L. 40-pr., 25, 16, 9, and 7-pr. (Colonial).

No. 4. Percussion, R.L., for 12; R.M.L., 7-pr., 200 lbs. and 150 lbs.

No. 5. Percussion, R.L., for 6; R.M,L. 2·5″.

No. 6. Metal E for 10; R.B.L. 20-pr.

No. 7. Time and percussion, 9 seconds 4, percussion small 6; B.L. 12-pr.

No. 8. Time and Percussion, 9 seconds 8; B.L. 12-pr.

No. 9. Time, Armstrong, 3, and percussion plain 3, R.B.L. 6-pr.

No. 1. Is of tin, rectangular, with a hinged lid, secured by two hinged clips. It is fitted internally with one longitudinal partition plate of tin and with nine cross plates, which divide it into 20 compartments, in each of which a fuze is carried. The lid has a lining of buff. The box is fitted with a brass loop at one end to serve as a handle.

§ 4237. No. 2. Is similar. but is fitted internally with a block of mahogany recessed to carry 18 R.L. fuzes.

No. 3. Is similar to No. 2.

No. 4. Is similar to No. 3, except in dimensions.

No. 5. Is for mountain service. See page 112.

§ 4705. No. 6. Is similar to No. 2.

No. 7. Is similar to No. 2, with the exception, that the lid is secured by one hinged clip at the end. It is fitted with a tab of leather internally to facilitate removing a fuze when the box is full. It is painted red.

No. 8. Is similar to No. 7, but is painted lead colour and is not fitted with a tab.

No. 9. Is a rectangular box with hinged lid secured by one clip. It is divided into 12 compartments by thin stripes of tin.

Boxes, grease. There are two descriptions of tin boxes for grease, magazine and half round.

The magazine is a rectangular box with hinged lid fitted with a hook, by which it is secured to a loop on the side of the box. There are two sizes, holding seven and fourteen pounds respectively.

The half round grease tin for field service holds 3 lbs.

Brushes, piasaba. These brushes are used with R.M.L. and R.B.L. guns ; each brush consists of an elm head, with piasaba grass glued into it, fixed upon a stave. The head of the brush is cylindrical and its total length in the case of the 9 and 16-pr. is the same as that of the sponge.

§ 2544. The latest patterns are Mark II for the 9 and 16-pr. and Mark I for 7, 13 and 25-prs.

Mark II brushes for 9 and 16-pr. are stronger than Mark I, and the holes in them for the bass are fewer and are arranged spirally.

§ 2813. Mark I brush for the 7-pr. has the same head as Mark II for the 9-pr., but is fitted with a shorter stave.

Mark I brush for the 25-pr. is similar to Mark II for the 9-pr.

The brush for the 13-pr. R.M.L. has the stave made in two pieces connected by a folding joint, fitted with a sliding collar of P.B.

§ 3354. The brushes for the 9 or 7-pr. R.M.L. are also used for the 12, 9 or 6-pr. R.B.L. guns.

Buckets, sponge. Sponge buckets are made of leather, and are similar to water buckets, but each is covered with a teak lid, in which there is a hole closed by a plug to admit the sponge.

Bullock draught. § 5005. The fittings manufactured in R.C.D. for this draught are as follows :—

| | |
|---|---|
| Bands, yoke | iron, with key and nut. |
| Bolts, pole | iron, with nut, field or siege. |
| ,, Splinter bar siege | iron, countersunk head and with nut for double loop. |
| Chain { lead { field, siege } pole { field, siege } } | iron |

Couples, chain { field / siege }
Keys, band, yoke — iron with nut, field or siege.
Loops, draught { field / siege } iron with bolts for axletree bed.
Poles { field / siege } wood with bolts.
Socket, pole, siege, — iron with bolts for axletree bed.
Staples — iron with bolts for splinter bar.
Yokes — wood, field or siege.

The pole is Pedowk 9′ 4″ long. A nib iron is riveted to it at the rear end, and the front end is shod with a curved plate. A vertical hole is made through it 15·875″ from the rear end for the pin, at each end of which a wrought-iron plate is attached by four screws.

The pole is bound with copper, where it rests in the splinter bar band. The bolts pass through two horizontal holes made in the front end of the pole at an interval apart of 6″. These bolts are square headed.

The yoke consists of an upper and lower cross bar of Pedowk, connected by two wrought-iron frame rods. Two hooks are fitted to eyebolts one on each side of the centre of the upper bar. On each end of the lower bar there is an eyebolt, on which an iron stay formed with a loop at each end fits. There is a ring on the loop at the free end of the stay, which fits over the end of the upper bar of the yoke and is secured by a fixed iron stop plate on the bar, and by a pin attached to the bar by a chain.

The yoke band consists of an iron clip swivelled to an iron ring. The ring is kept on the point of the pole by the two pole bolts, and the clip is fixed to the centre of the yoke upper cross bar by the "key, band, yoke."

The draught loops are bent iron clip plates, formed each with a loop at one end. They are secured to the axletree and bed of the limber, each by two bolts.

The pole chain is of wrought-iron, size of link ½″, length 9′2¼″; near the rear end there is a ring, on which there are two short pieces of chain, each consisting of three links with a hook at the end. Near the front end there is also a ring, on which there are two short pieces of chain, each consisting of two links with a ring at the end.

The lead chain is of wrought-iron, length 8′8″. It has a ring near the front end, on which are two short pieces of chain, each consisting of two links and a ring; at the rear end there is a hook.

These cans have been placed in a numbered series. Cans lubricating.

The following are the cans for field service:—

No. 2. 20-pr. R.B.L. 2½ pints.
No. 3.* 12, 9 and 6-pr. R.B.L. / 13, 9 and 7-pr. R.M.L. } 2¼ pints.
No. 5. 16 and 25-pr. R.M.L. 1¾ pints.
No. 2. Is a rectangular tin can with straight sides and curved top. § 3257.

* No. 3 can is also used with the B.L. 12-pr.

In the centre of the top there is a filling hole with socket closed by a metal screw plug. At one corner at the top there is a small hole with socket into which is screwed a metal discharge nipple, a brass cap screws on the top of the nipple and is secured to it by a short brass chain.

External dimensions 6″ × 2½″.
Total height 8″.
§ 2054. Weight 1 lb. 3½ ozs.

No. 3. Is similar except in dimensions.
External dimensions 3½″ × 4⅞″.
Total height 6⅞″.
§ 3198. Weight 1 lb. 1½ oz.

No. 5. Is also generally similar to No. 2 except in dimensions. It has no cap on the discharge nipple and the top is fitted with a handle.

Caps, canvas, sponge. See Part II. p. 339.

Cases, carbine. These are leather cases formed to carry each a M.H. carbine, they are secured by straps to staples on the front of the limber boxes.

Case, pocket fuze. This is a brown leather case with a flat lid, with a strap, which is secured to a buckle on the front of the case. A second buckle is attached to one side of the case and a strap to the other, which passes through two staples on the carriage, and through a loop on the back of the case.

Case, pocket tube. This case is similar to the above, but is semicircular in form.

Chains, drag, shoe. The chains have been placed in a numbered series. The following are the chains for field service:—

| | Length. | | Size of Link. |
|---|---|---|---|
| | ft. | in. | in. |
| No. 10. Carriage R.M.L. 25, 16, and 9-pr., S.B. 24 and 12-pr. howitzers, wagon, B.L. 12-pr. R.M.L., 40, 25, 16, 13, and 9-pr., and forge and store wagon .. .. .. | 7 | 4 | ½ |
| No. 11. Carriage R.B.L., 20-pr. .. .. .. .. | 5 | 7 | ½ |
| No. 12. Carriage R.B.L., 12 and 9-pr. .. .. .. | 5 | 3½ | ½ |
| No. 13. Carriage R. M.L., 13-pr. .. .. .. .. | 6 | 3 | ½ |
| No. 14. Carriage 7-pr. Colonial .. .. .. .. | 5 | 10½ | 7/16 |
| No. 15. Ammunition wagon R.B.L. and S.B. .. .. | 7 | 4 | ½ |
| No. 16. Ammunition wagon 7-pr. Colonial .. .. .. | 7 | 4 | 7/16 |
| (The drag chain of the R.A. ammunition and store wagon is attached to the shoe, and is not therefore included in the above series.) | | | |

Cleaner, 12-pr. piasaba. This cleaner consists of a hollow block of elm with piasaba grass attached to it at each end. The block is secured by two knots on the centre of a rope lanyard 17′ 9″ long, which passes through it. At one end of the lanyard there is a loop and at the other a lead ball.

Cleaner, 12-pr. wool. This is similar to the above, but the block is covered with fleecy hosiery.

Trace couples are small pieces of round iron, with an eye formed in each end, bent into something the shape of a link until the ends are about $\frac{1}{4}''$ apart. A trace couple is used to replace temporarily a broken link, the links adjoining the broken one being hooked upon the couple and prevented from coming off by a tie through the eyes of the latter. There are two natures of couples, the heavier for field artillery service of $\frac{3}{8}''$ iron, about 6″ long before being bent, and the lighter for transport service of $\frac{1}{4}''$ iron, about 5″ long before being bent. Couples, trace

This is a leather disc, rounded to suit the breech of the 12-pr. It has a leather rim sewn on; to this rim is attached a leather tab to cover the vent, with a loop, and two straps for securing the cover on the gun, one of them with a buckle. Cover, breech B.L. 12-pr. leather.

Covers for vent slots of R.B.L. guns are of waterproofed canvas, tacked at the middle part to a hollow wooden case, which is grooved to fit accurately the vent piece of the gun for which it is intended. Each cover has straps and buckles for securing it on the gun, and leather patches to prevent the sights injuring it. Covers, vent slots.

See p. 30. Deflectors.

This is a leather pocket with flap, which forms a cover, and which has a strip of leather sewn on it to serve as a tie. On the inside of the flap a flat strip of leather is sewn to carry the needles. Holdall, needles, and worsted.

§ 3865.

| | | |
|---|---|---|
| Size, external | length .. | $6\frac{3}{8}''$ |
| | width .. .. | $2\frac{7}{8}''$ |
| | thickness .. | $\frac{1}{2}''$ |
| Weight .. .. .. .. | | 1 oz. |

The common or field jack is used with the 25-pr. and lower natures.

Mark I jack consists of a pedestal of ash fitted with a forked end of wrought iron. A lever is supported by a pin in the fork, the position of which can be varied to suit the heights of the axletree in different carriages. A movable pawl is attached to the lever, which drops into the teeth of a rack upon the back of the fork to keep the lever in position when the weight is upon it. The weight of the jack is 17 lbs., and it is sufficiently strong to lift half a ton. Jacks, lifting. (Plate XXIII). L. of C. § 1023.

Mark II field lifting jack was approved to guide conversion of Mark I, so as to render it suitable for wagons with the new pattern axletrees. It differs from Mark I in being 1″ lower, the racks longer, and the point of the counter-lever prolonged and made hook-shaped. Weight $19\frac{1}{2}$ lbs. L. of C. § 2957.

Having been found not to be sufficiently strong for artillery or engineer carriages, it is now issued for transport service only. L. of C. § 3609.

Mark III field lifting jack, suitable for all services, is stronger than the preceding in the iron strap and in the lever handle, the point of the counter-lever also is slightly hollowed, to prevent it slipping when under an axle. Weight, 29 lbs. L. of C. § 2958.

Mark II maul for general use in the field (or garrison) has the head of elm iron bound, and the handle or helve of ash (identical Mauls.

with that of the pickaxe); it weighs 12 lbs. Mark I maul is similar to Mark II, but its head is not bound with iron.

Posts, picket. § 5029. Picket posts are of ash, pointed with iron and bound at the other extremity with an iron hoop; below the latter an eye staple is fixed for the reception of the picket ropes or a lashing rope. The picket posts used in the field are 2½′ long, except those carried with the platform wagon, which are 5′. Mark II 2½′ post is slighter than Mark I, and has an iron loop driven through the post, and its end riveted over a washer, instead of having a staple with its ends clenched.

Ropes, drag. Drag ropes are "heavy" and "light;" at one extremity each has an iron hook, painted black, and at the other an eye-splice lined with leather. The light drag rope is of 2″ white rope, and is 15½′ long from the bearing part of the hook to the eye-splice; it is issued to 9 and 12-pr. R.B.L. batteries, to 9-pr., 13-pr., and 16-pr. R.M.L. and to 12-pr. B.L. The heavy drag rope is of 3″ white rope 30′ long, and has a slot in its hook to receive a tie attached to the shank. This drag rope is issued with the 20 and 40-pr. R.B.L. batteries and 25-pr. R.M.L.

Ropes, picket. Picket ropes are of 3″ tarred rope, each 25 yards long.

Shafts have been placed in a numbered series. The following are those for field service:—

Shafts. No. 1. Near shaft, for wood limbers 9-pr. to 20-pr. R.B.L., iron limbers 9 to 25-pr. R.M.L. forge and store wagon, and steel limber 12-pr. B.L.

No. 2. Off shaft for wood limber 9 to 20-pr. R.B.L., 2nd class A.

No. 3. Off shaft for iron limbers 9-pr. to 25-pr. R.M.L., and forge and store wagon.

No. 4. 6-pr. service near.
No. 5. „ off.
No. 6. 6-pr. special near.
No. 7. „ off.
No. 8. 7-pr. Colonial also 45 Gatling near.
No. 9. „ „ „ „ off.
No. 19. Off shaft steel limber 12-pr. B.L.

The near shaft is the same for both the wood and iron field limbers; the off shaft differs in the form of the Brandling iron, corresponding with that of the axletree arm over which it fits in each case.

Shoes, drag. These have been placed in a numbered series. The following are used in field service.

No. 3. 28 lbs. Field carriages and ammunition wagons (except 12-pr., 13-pr. and 7-pr.), R.A., forge and store wagons.

No. 4. 34 lbs. R.A. ammunition and store wagon, with chain attached.

No. 5. 21½ lbs. R.M.L. 13-pr. and 7-pr, B.L. 12-pr.

Spanners. The spanner used in the field is "McMahon's 15″;" it is formed of a bar of iron 15″ long, at the extremity of which a claw is fixed, and underneath the latter another moveable claw sliding on the bar, which can be set at any required distance from the

first by means of a thumbscrew fixed to it at the back and working in a rack formed on the bar.

Swingletrees are of ash, having a socket with trace loop at each extremity, and a socket with hook at the centre for attachment to the carriage; they are of three descriptions. The field swingletree is No. 2, 2′ 4″ long. Swingletree.

Tampeons are of elm, the portions which enter the bore being covered with two or three thicknesses of collar cloth glued on. In the 13-pr. tampeon, the rope grummet originally issued with it, has been replaced by a leather strap, intended to pass over the muzzle sight of the gun so as to secure the tampeon in the bore. The strap is attached to the tampeon head by two iron screw studs. Tampeons.

This tampeon consists of two discs of elm connected by a leather casing stuffed with horsehair. A metal spindle passes through the outer of the discs, and screws into a nut riveted to the inner one. By turning the spindle the discs are drawn together, and the casing expanded so as to make it fit tightly in the bore. A metal plate is attached to the face of the outer disc, and the end of the spindle is fitted with a metal ring to serve as a handle. Tampeon expanding B.L. 12-pr.

Ties are formed of strips of leather about 5″ long. To form a tie one end of a strip is doubled over $\frac{1}{4}$″, and a bit of stouter leather placed in the double; a hole is then made through the three folds, and the other end of the strip passed through and drawn tight; this forms a button, and a button hole is cut at the other extremity, Ties.

## SECTION III.—SIEGE ARTILLERY CARRIAGES.

### CHAPTER I.—WOODEN SIEGE ARTILLERY CARRIAGES.

The following are the chief wooden carriages for siege service still in existence:— Table.

| Nature. | Weight, empty. | | | Tonnage. |
|---|---|---|---|---|
| | cwt. | qrs. | lbs. | Tons. |
| 5½″ mortar bed .. .. .. .. .. | 0 | 1 | 0 | 0·11 |
| 10″ „ carriage .. .. .. .. .. | 19 | 3 | 24 | 2·14 |
| „ limber .. .. .. .. .. | 8 | 2 | 9 | |
| 8″ „ carriage .. .. .. .. .. | 12 | 0 | 24½ | 3·68 |
| „ limber .. .. .. .. .. | 8 | 2 | 9 | |
| 40-pr. R.B.L. of 35 cwt. gun carriage .. .. | 30 | 1 | 0 | 6·18 |
| „ „ limber .. .. .. | 12 | 0 | 0 | |
| Platform wagon .. .. .. .. .. | 23 | 1 | 0 | 3·11 |
| Sling „ .. .. .. .. .. | 36 | 1 | 0 | 3·95 |
| Trench cart .. .. .. .. .. .. | 7 | 0 | 0 | 1·57 |

## 40-pr. R.B.L. Gun Carriage and Limber.

40-pr. R.B.L. gun carriage. R.C.D. Photo-Lithograph, 40.

This carriage takes No. 1 axletree, and No. 1 wheels, 1st class A pattern. Except when issued for the siege train it is fitted with a traversing arrangement similar to that of the 20-pr., and has two sets of trunnion holes, "firing" and "travelling." A gun roller of sabicu, 14″ long, is used for shifting the gun upon from one set of trunnion holes to the other, which when not in use is slung by a grummet upon a hook on the breast of the trail. To prevent the gun injuring the traversing screw in being shifted, a cleat is fixed across the trail to the rear of the elevating screw. In travelling, the elevating screw and its handle are carried in leather pockets for the purpose on the right of the carriage, and the gun is secured by breech and muzzle straps.

The carriage is not fitted for a traversing handspike, but carries instead five common handspikes; it has four trail handles and no axletree boxes.

The elevating screw is the "ratchet head No. 90," attached neither to the gun nor to the carriage. The head of the screw is the same as the head of the screw jack described, p. 103. The nut for the screw is square, and rests in a metal socket or pan in the trail. The drag shoe is No. 1 with $\frac{3}{4}$″ chain No. 2; the rammer and the sponge are separate, and the head of the former in one piece with the stave.

The first carriages used for the 40-pr. were converted from the 18-pr. S.B. carriages, and were not fitted with a traversing arrangement.

40-pr. R.B.L. limber; "siege limber."

The 40-pr. limber takes the heavy field wheel, No. 14 2nd class A, and differs from the 12-pr. R.B.L. or field limber, chiefly in having a straight pintail with keep chain instead of a limber hook with key, and in being fitted for four-horse draught. This is arranged by an "off" and "near siege" shaft, the latter the same as the field shaft, placed in the same manner as for double draught in the field limber, and by a pair of "siege frame" shafts on the near side of the former, together with an outrigger for a swingletree at each extremity of the splinter bar. Each outrigger is strengthened by a stay to the axletree arm, and when not required is folded back upon the splinter bar, the stay being strapped upon the platform board.

When the 40-pr. is issued to volunteers, the shafts of the limber are fitted for farmer's draught, that is, with a back band and with staples for the attachment of the hooks or tees of short traces.

Some 18-pr. S.B. limbers have been converted to 40-pr. simply by altering the internal fittings of the boxes. The altered boxes are slightly deeper than those made new.

## 10″ Mortar Carriage and Limber.

10″ mortar carriage. (R.C.D. photo-litho-graph 49).

The 10″ mortar carriage consists of a bed formed of planks of oak bolted together, the outer ones serving as brackets, with an axletree let into and secured in its under side, and a perch pro-

jecting from the rear. A quoin is fitted over the front of the carriage to give the mortar the necessary elevation, and bolts at each side for running up.

For travelling the axletree takes 4′ 2″ wheels, No. 16, 2nd class A (track 4′ 3½″), and the perch is attached to a limber. In battery, the carriage is unlimbered, the wheels removed, and the body laid flat upon the ground.

Limber.

The limber is somewhat similar to a trench cart, but fitted with a limber hook, movable shafts (No. 4 near, No. 10 off), and outriggers for treble draught. Movable blocks are fitted in the bottom of the cart to secure the shell in travelling..

8″ mortar carriage.

The carriage and limber for the 8″ mortar are similar to the above.

## 5½″ Mortar Bed.

5½″ mortar bed.

The 5½″ mortar bed is a simple rectangular block of oak, hollowed out to receive the mortar and fitted with quoin, cap-squares and rope handles.

## Platform Wagon.

Platform wagon. (R.C.D. photo-litho-graph, 51.)

The platform wagon consists of a fore and hind carriage with a platform fitted over them.

The hind carriage is formed of an axletree bed and bolster with a perch housed between them, a field axle, and wheels No. 13, 2nd class A, 5′ in diameter, 4″ in width of tire, and having a track of 5′ 2″.

The fore carriage consists of an axletree bed and bolster with two futchells housed between them, a splinter bar bolted over the futchells in front, and a sweep bar in rear, an axletree slightly longer than the field axletree, and wheels No. 17, 2nd class A, 4′ in diameter, and 4″ wide in the tire.

The platform consists of a strong oak frame, with side boards attached, which is bolted to the bolster of the hind carriage, and pivots on the bolster of the fore carriage. The main pin, which connects the platform with the fore carriage, also passes through the perch of the hind.

The splinter bar is fitted with two pairs of siege frame shafts and with outriggers for swingletrees, so that four horses can be harnessed abreast; it is also fitted for a pole for bullock draught.

Upon the sides of the wagon are cleats for carrying either a mortar, mortar bed (10″ mortar and bed, 13″ mortar or bed, or two 8″ mortars and beds), or S.B. gun.* A canvas bag is supplied with the wagon, when issued for R.B.L. batteries.

Issued with a 40-pr. battery of position, the wagon is fitted for carrying a spare siege axletree and wheel, two spare field axles, one spare axle and wheel for the wagon fore carriage, and other stores. And issued with the wagon are seven bale hoops and canvas cover, five swingletrees No. 1, 14 lashing ropes, a wooden tool box, and a drag shoe with chain.

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* § 5034. The wagon is suitable for carrying the 6·6″ gun or the 8″ 70 cwt. howitzer.

### Sling Wagon.

Sling wagon.

See Part II, garrison service.

### Trench Cart.

Trench cart.

The trench cart is a strong cart capable of carrying a load of one ton; it has a second class A pattern axletree, with No. 16 2nd class A wheels, 4′ 2″ in diameter (having a track 4′ 3½″), fixed shafts, and moveable sides, head and tail board. The frame is of oak, and the boarding of elm.

The cart is painted red to distinguish it from the hand cart.

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## CHAPTER II.—IRON SIEGE ARTILLERY CARRIAGES.*

The following are the carriages, beds, &c., for the present siege train:—

| Nature. | Weight.* | | | | | | Tonnage. |
|---|---|---|---|---|---|---|---|
| | Empty. | | | Packed. | | | |
| | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | tons. |
| 6·6″ R.M.L. carriage, hydro-pneumatic .. | 52 | 1 | 16 | | — | | 9·562 |
| 25-pr. R.M.L. carriage, with top carriage.. | 22 | 0 | 0 | 40 | 3 | 0 | †1·567 |
| 40-pr. R.M.L. of 34 cwts. carriage, Mark I. | 27 | 0 | 5 | 61 | 3 | 14 | 4·058 |
| 40-pr. R.M.L. of 34 or 35 cwts. carriage, Mark II. .. .. .. .. .. | 32 | 2 | 0 | 68 | 2 | 6 | 4·058 |
| Ditto, with top carriage .. .. .. | 42 | 0 | 0 | 78 | 0 | 6 | †1·039 |
| 6·3″ R.M.L. of 18 cwts. howitzer carriage, Mark I. .. .. .. .. .. | 32 | 2 | 0 | 51 | 2 | 6 | 4·058 |
| 6·6″ R.M.L. of 36 cwts. howitzer carriage, Mark I. .. .. .. .. .. | 32 | 2 | 0 | | — | | — |
| 8″ R.M.L. of 70 cwts. howitzer carriage, Mark I. .. .. .. .. .. | 45 | 0 | 0 | | — | | 5·893 |
| 40-pr. R.M.L. limber, Mark I. .. .. | 13 | 0 | 27 | 19 | 2 | 26 | 2·658 |
| 6·6″ R.M.L. H.P. carriage, limber, Mark I. | 11 | 3 | 13 | | — | | — |
| 7-pr. R.M.L. 200 lbs. bed .. .. .. | 2 | 0 | 0 | | — | | 0·335 |
| Forge wagon, with limber .. .. .. | 30 | 0 | 12 | | — | | 5·820 |
| Platform wagon .. .. .. .. | 22 | 0 | 0 | | — | | 3·11 |
| Store wagon, with limber .. .. .. | 25 | 0 | 24 | | — | | 5·820 |
| Sling wagon, with limber .. .. .. | 44 | 2 | 4 | | — | | — |

* With stool bed, coins and roller. † Top carriage only.

The following carriages are included under the heading of "siege," although not forming part of the present train:—

R.B.L. 40-pr. 6′ parapet. Weight. 26 cwts. 3 qrs.; tonnage, 7·867.

R.M.L. 8″ howitzer of 46 cwts. Weight, 45 cwts. 0 qrs. 4 lbs.; tonnage, 5·284.

* For description of steel carriage for B.L. 4″ and 5″ gun, see Appendix H.

## 25-pr. R.M.L. Gun Carriage.

25-pr. R.M.L. gun carriage. Mark I. Plate XX.

The 25-pr. gun carriage when used for siege service is fitted for overbank fire with a "top carriage" to fire over a parapet 5′ 8″ high at 5° of depression.

This top carriage is composed of two skeleton brackets, each formed of three double stays, the two front of plate iron, the rear of plate iron outside and angle iron inside, so as to give sufficient bearing surface for the trunnions of the gun to slide on in shifting from firing to travelling positions.

These are riveted at their lower ends to a forging of T-section, and at the upper ends to a semicircular piece of T-iron, which forms the trunnion holes. The forgings to which the lower ends are riveted rest upon the brackets of the original carriage, and extend along them for some distance. They have projections formed on them, which fit into the trunnion holes. The skeleton brackets are connected by four transom bolts, one of which passes through the projections which fit into the trunnion holes. The front of each bracket is held down by two strong holding down bolts, one inside the bracket and the other outside.

These bolts have eyes in their upper ends, through which passes the transom bolt which lies in the trunnion holes of the low carriage. Their lower ends, which have screw threads cut on them, pass through holes in a coupling plate which fits underneath the bracket, and they are then secured by nuts. In rear the top carriage is secured by clips which catch under the flange of the angle iron frame of the low carriage, and by bolts through that flange.

Near the bottom of the rear stays the angle iron is forged to form travelling trunnion holes, and about half way down hooks for the gudgeons of the shifting roller are so pivoted that when they are shut down, they shall not project beyond the surface of the stay.

Eye bolts for tackle used in shifting are attached to the top of the brackets in front; a wood step for No. 1 to stand on when laying the gun is also added.

The gun is elevated by means of an arc, one end of which is bolted to the gun near the breech, and the other in front of the trunnions.

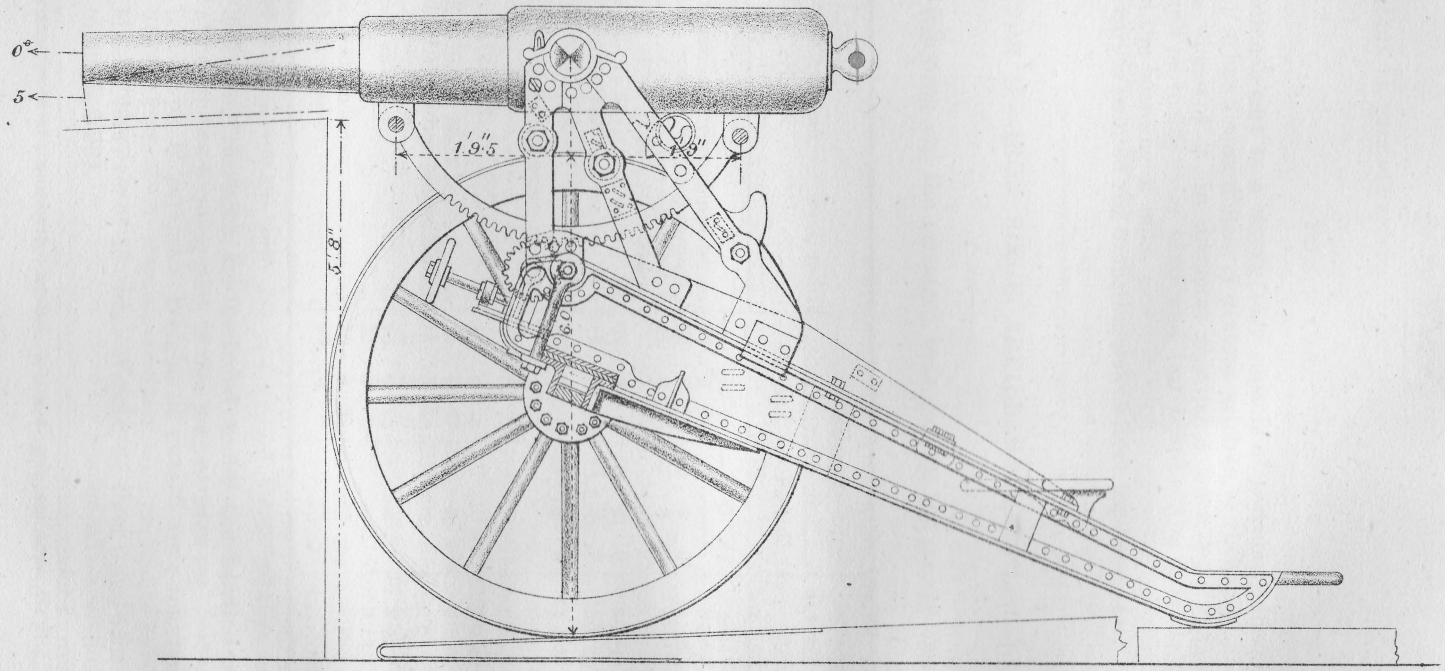
Between the brackets of the low carriage, at the breast, is bolted a "front plate," on which is carried in gun metal bearings a short horizontal shaft lying across the carriage. On this shaft is a pinion which works the arc, and also a worm wheel with friction cone; the latter is turned by a worm, the spindle of which projects to the front, and has a hand wheel at its extremity.

For loading, the rammer stave is made in three pieces connected by joints, which can be stiffened by means of sliding collars. The sponge stave is made of wire rope served with ½″ tarred rope.

Two steel spanners are issued for use with each overbank

# CARRIAGE, 25 PR. R. M. L.

*Scale, $\frac{1}{2}$ Inch to a foot.*




DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12452.

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carriage, one for tightening the locking nut of the elevating gear, the other for general purposes. A knock up wrench is also issued for turning the larger nuts.

L. of C. § 3454. The top carriages will allow fire over a parapet 5′ 6″ in height at 5° of depression.

For transport the top carriages and the front plate with the cross shaft and pinions are removed, and are packed in a wood case, in which are also carried the arc, the sponge and rammer, the gun sights, and all the articles belonging to the carriage, or necessary for preparing it for service.

In this case is also carried a smaller one containing the arc, the pivot piece, and all the fittings peculiar to the carriage in its low or original form. This case accompanies the carriages, so that in case of necessity the top carriage can be removed, and the carriage used in its low form.

Each case is marked outside with the register numbers of the particular carriage and gun to which the contents belong.

## 40-pr. R.M.L. Gun Carriage and Limber. Mark II.

40-pr. R.M.L. gun carriage. Mark II. Plate XXI. L. of C. § 3005. The 40-pr. R.M.L. gun carriage is constructed in the same manner as the 9-pr. R.M.L. carriage, Mark II, that is to say, the brackets have the plate, which is lightened out, on the inner side of the angle iron frame, the axletree bed is of wrought-iron, and the trail piece fits between the points of the brackets.

There are three transoms riveted to the brackets, the connection of the third transom being strengthened by a strong stay, while the front transoms are also riveted to the bed. An angle stay is also riveted to the rear of the axletree bed and to each bracket.

The wheels are No. 6 1st class B, shod with ring tires $\frac{3}{4}$″ thick, and not having the flanges of the nave projecting beyond the pipe box; their track is 5′ 2″.

The trunnion holes are, as in the wooden 40-pr. carriage, firing and travelling, sufficient bearing being obtained for the trunnions by riveting a solid piece to the inside of each bracket; the height of the axis of the firing trunnion holes is 4′ 5″. A gun roller for moving the gun upon from one set of trunnion holes to the other is carried strapped on the breast of the carriage, a stool bed or shifting plank for it to run upon resting in front upon a piece of angle iron riveted to the front transom and in rear upon a piece riveted to the rear transom.

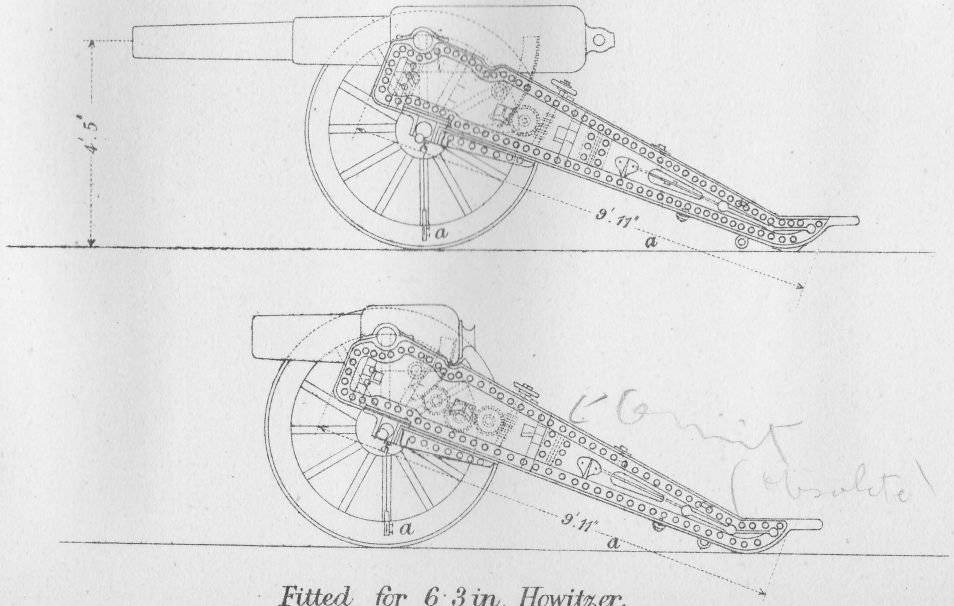
The gun is elevated or depressed by means of gear similar to that of the 25-pr. field carriage, but with locking as well as adjusting nut.

In case of damage to the elevating gear, coins, which are carried betwen the brackets, can be used in conjunction with the stool bed for laying the gun.

As in the wooden siege carriages, there are four trail handles, no axle boxes, and no fittings for a traversing handspike; instead of the latter, five common handspikes are carried, one strapped on

# CARRIAGE, SIEGE, R.M.L. 40 Pr. GUN, AND 6·3 In. HOWITZER, MARK II.

*Scale 1/48th full size.*




*Fitted for 6·3 in. Howitzer.*

12447.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN.

*To face page 80.*

Plate XXI.

the top of each bracket, point to the rear, and three on the side of the left bracket, points to the front.

The drag shoe with chain is fitted on the left of the carriage, underneath are fittings for the sponge, rammer, wadhook, and a 12′ lever; the pocket for the priming irons is strapped on the rear transom, and a pocket to carry the tube pocket on the right bracket. There are also fittings to take a hammer, &c. L. of C. § 2814.

When the gun is in the travelling trunnion holes it is secured by a breech and muzzle strap to staples for the purpose, the elevating arc being then detached from the gun and carried in metal rests on the left bracket, and the hand wheel of the worm shaft upon a stud on the rear transom, secured by straps.

The carriage is prepared for the elevating gear of the 6·3″ howitzer, the arc for which can be carried on the left bracket and an additional pinion on the rear transom.

The top carriage for overbank fire is similar to that of the 25-pr. both in construction and fittings; but the forgings which form the bottoms of the brackets do not extend down the brackets of the low carriage further than is sufficient to give room for one bolt. The elevating gear, and the sponge and rammer staves are also similar to those of 25-pr. Top carriage.

The limber is generally similar to the field limber Mark II for the 9-pr. R.M.L. gun carriage, it is fitted for four horse draught with a pair of frame shafts on the near side of the single shafts and an outrigger at each end of the bar to take a swingletree, each outrigger is connected by a stay to the washer on the axle. When not required the outriggers can be folded back upon the splinter bar, their stays being removed and strapped on. The wheels are No. 25, 2nd class B. Limber, iron, siege. Plate XXII.

The boxes are of the same external dimensions and fittings as those of the field limbers. The off and near boxes carry each six rounds, the projectiles steadied by cleats and fitted with lifting straps; weight of each box packed 3 cwts. 1 qr. 2 lbs.

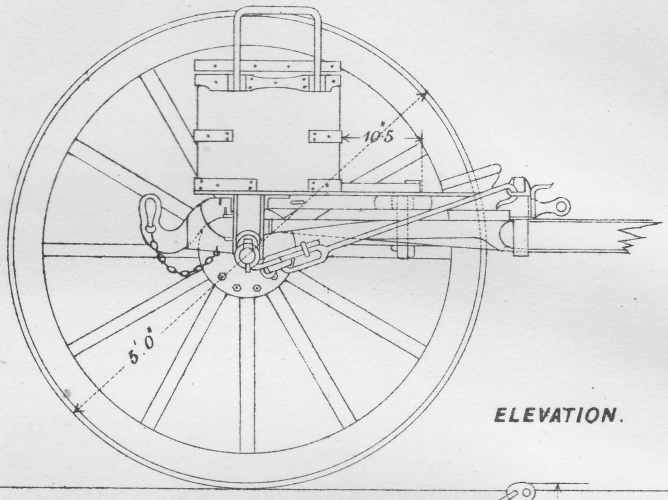
The limber has fittings to carry a screw lifting jack, three swingletrees (No. 1), a pair of drag ropes (heavy), and the usual entrenching tools.

### 40-pr. R.M.L. Gun Carriage and Limber. Mark I.

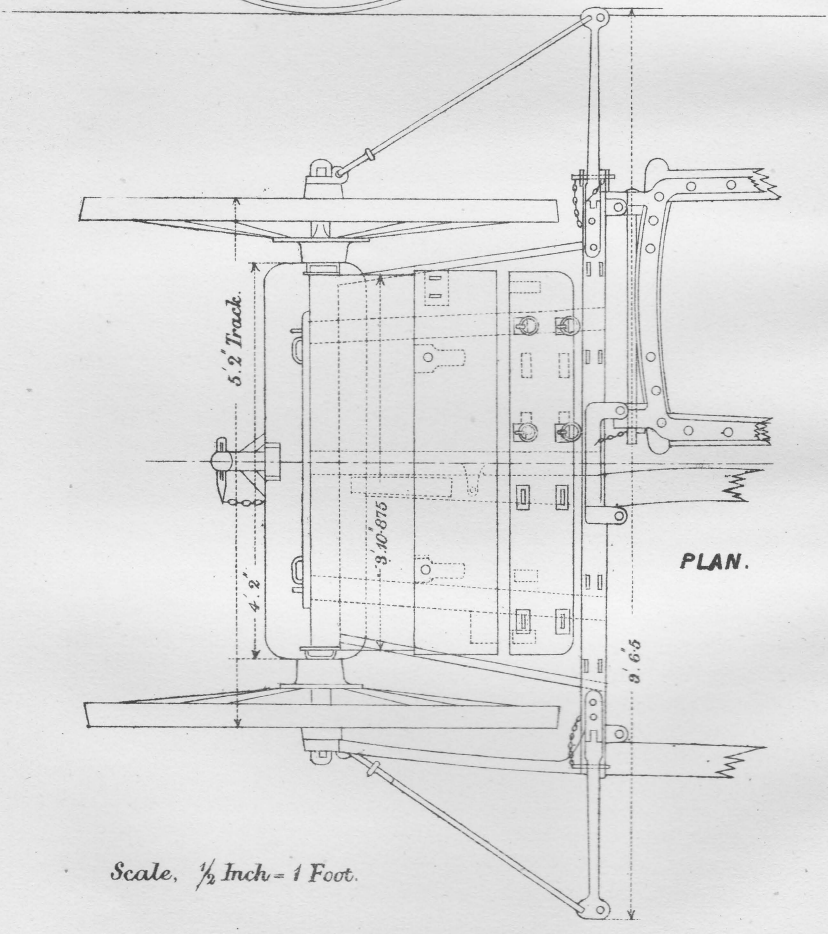
This carriage differs from Mark II in being of weaker construction; it has only two transoms. On account of the breech of the 40-pr. of 35 cwt. from its length fouling the second transom that gun cannot be mounted upon it. 40-pr. R.M.L. gun carriage. Mark I. L. of C. § 2692.

It takes the same limber as Mark II carriage.

# LIMBER, SIEGE, R.M.L. 40 PR GUN.




ELEVATION.




PLAN.

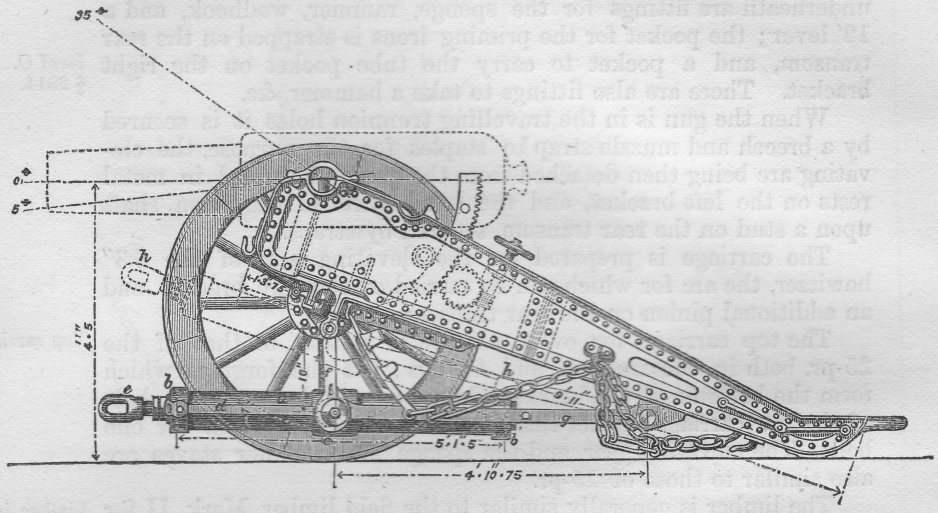
*Scale, ½ Inch = 1 Foot.*

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DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

## 6·6″ R.M.L. Howitzer Carriage.

Fig. 16.




**6·6″ R.M.L. howitzer carriage. § 4432.**

The carriage for the 6·6″ howitzer is the 40-pr. carriage, Mark II, fitted with a hydraulic buffer to check ~~recoil~~. intensity of recoil

**Buffer, hydraulic.**

The hydraulic buffer consists of a cylinder containing oil attached to the carriage, and a piston working in it, with piston rod attached, when in use, to an anchorage fixed to the parapet. On the howitzer being fired, the cylinder is drawn back with the carriage, and the piston rod being held by the anchorage, the oil is obliged to pass from front to rear of the piston through small holes made in it for the purpose; the resistance of the oil to the motion checks the recoil.

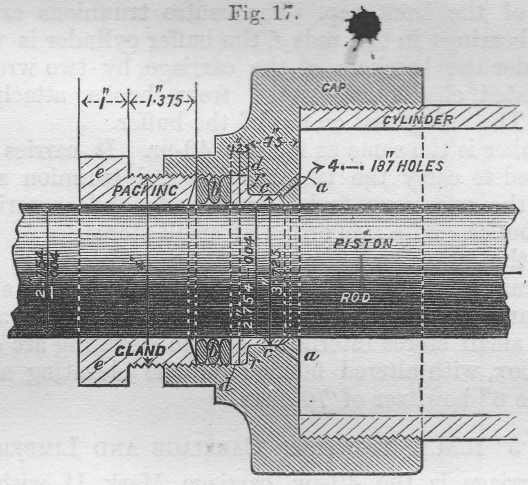
The cylinder is of wrought iron,* ·55″ thick, 6″ internal diameter, closed at each end by a wrought iron cap screwed on. The rear cap is solid ended, and is formed with a hexagon at the back to facilitate its removal. The front cap is formed with a stuffing-box, through which the piston rod passes, and has a trunnion forged on it at each side. A trunnion ring with trunnions is shrunk on the cylinder at the centre; the centre and front trunnions are connected by a wrought iron tie bar on each side. A loop washer is placed on each front trunnion outside the tie bar, and is secured by a nut. The centre trunnions are also connected by a wrought iron bar *g*, on each side of the cylinder, with a steel bolt 2·25″ diameter, which rests in wrought iron brackets riveted under the trail, and is secured by a nut and pin. When prepared

* For future manufacture the cylinders of all natures of hydraulic buffers will be of steel. The steel tubes will be stamped with the letter S near the filling hole. § 4910. In future issues the hydraulic cylinder will be reversed and attached to the central pivot plate of double-decked platform, see page 98. This applies also to 6·3 and 8″ howitzer.

for action, the centre trunnions rest in bearings at the lower end of rods *f*, in which they are secured by hinged capsquares with French keys. The rods *f* are of wrought iron, they are connected by a cross bar and are suspended by wrought iron bolts 1·5″ diameter, which are held in wrought iron brackets riveted to the under side of the axletree, and are secured by nuts and pins. A washer, nut and pin is placed on the outer end of each trunnion outside the rod *f*. There is a filling-hole in the upper side of the cylinder just in front of the rear cap, closed by a wrought iron screw plug, with leather packing, which is attached by a chain to the rear cap; a metal draw-off cock is attached to the under side of the cylinder in rear of the front cap by four screws. A wrought iron supporting bracket is fixed by two screws to the under side of the front cap. The piston is of wrought iron 2″ thickness, 6″ diameter. It has four holes through it, each ·35″ diameter. The piston rod is of wrought iron, 2·75″ diameter; length, 5′ 5″. The piston is screwed on the rod and secured by a keep-screw, and by the end of the rod being hammered over a little. A wrought iron shackle is screwed on the front end of the piston rod and secured with a tapered steel pin. For use the rod is connected with the anchoring arrangement described p. 101.

Packing for piston rod:

Fig. 17.




The packing placed round the piston rod in the stuffing-box formed in the front cap consists of the following parts:—

A cup leather *c*.

A brass ring *d*.

Three rings of two-inch white cotton rope, *b*, saturated with tallow, the ends bound with cotton yarn, put in so as to break joint.

A metal packing gland *e*, which is screwed into the cap and presses tightly on the cotton rope.

To make the joint tight there are four channels *a*, *a*, through the cap leading to the cup leather, through which the oil can pass, and thus act directly on the cup leather keeping it firmly pressed against the piston rod.

A metal inscription plate is attached to the outside of the cylinder in rear by screws. This plate gives the diameter of holes in the piston rod, and the proper working quantity of oil, that should be used.

The following stores are issued with each buffer :—

Spanner, hydraulic buffer No. 1 for cap and gland.
" " No. 6 for plug and cock.
Measure, filling.

Spanner No. 1 is of steel double ended, length 2′ 5″. One end is used for the cylinder cap, and the other for the metal packing gland.

Spanner No. 6 is of wrought iron, double ended, and one end is used for the filling hole plug and the other for the draw-off valve.

The filling measure is of tin and contains one gallon. There are ribs round the inside by which 1 quart, 1 pint, ½ pint, and ¼ pint may be measured. It has a metal cock which fits into the filling hole of the buffer.

For travelling the piston rod is disconnected from the anchorage, pushed home into the cylinder, and secured by a leather strap, passed through the shackle, and the loop washers on the trunnions of the front cap. The centre trunnions are released from their bearings in the rods *f*, the buffer cylinder is raised and secured under the brackets of the carriage by two wrought iron double twisted chains suspended from hooks attached to the brackets. The rods *f* rest on top of the buffer.

The limber. § 4631. The limber is the same as for the 40-pr. It carries one store box arranged to carry the two tangent and trunnion sights with cross bars, the necessary tools, spare parts and material for the hydraulic buffer, and a proportion of small stores.

§ 4629. When the howitzer is employed otherwise than as part of the siege train, the limber carries a smaller box, with sloping lid, fitted to carry two tangent and two trunnion sights, and a proportion of small stores internally, and an elevating arc externally. The same box, with altered fittings for the elevating arc, is also used for the 8″ howitzer of 70 cwts.

### 6·3″ R.M.L. Howitzer Carriage and Limber.

6·3″ R.M.L. howitzer carriage and limber. § § 3005, 4593. The carriage is the 40-pr. carriage, Mark II, with a special elevating arc, and two additional pinions, one of which gears into that of the 40-pr. elevating gear, the friction roller being moved to the front. It is fitted with the same hydraulic buffer as the 6·6″ carriage.

The limber is the same as that for the 6·6″ howitzer, and carries the same store box when forming part of the siege train. When employed otherwise, it carries a box similar to that for the

§ 4630. 6·6″ howitzer under the same circumstances, but differing from it in the arrangement of the fittings on the lid. The same box with altered fittings for the elevating arc is also used for the 8″ howitzer of 46 cwts.

## 8″ R.M.L. 70 cwt. Howitzer Carriage and Limber.

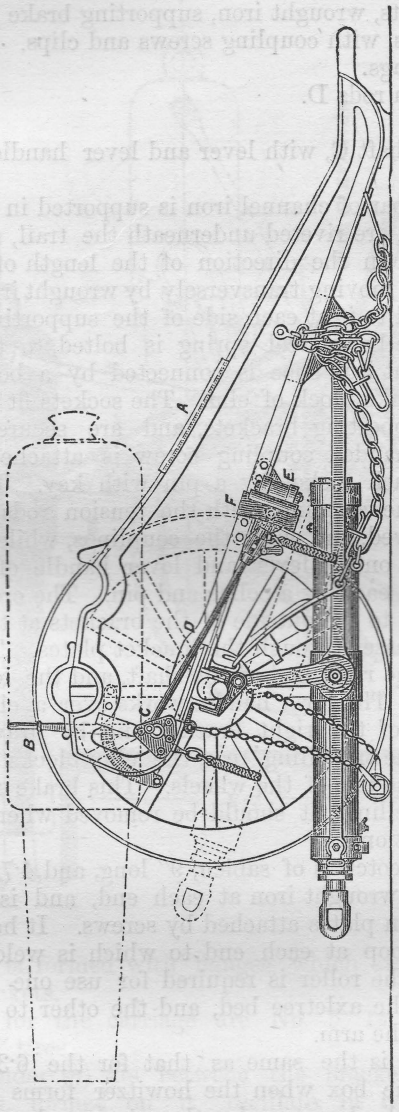



Fig. 18.

The carriage is the same as that made originally for the 64-pr., § 2693, with the addition of a transom plate A, fixed across the brackets of the trail. It is similar in construction to that for the 40-pr. R.M.L., and is fitted with a hydraulic buffer, a brake, a roller scotch, and two drag shoes with chains.

8″ R.M.L. howitzer, 70 cwt. carriag and limber. § 4531.

The buffer is the same as that for the 6·3″ and 6·6″ howitzers, and has similar fittings.

Brake.

The brake consists of the following parts:—

A brake bar of channel iron, with two steel springs E, iron shoes, and brake blocks F.

Two brackets, wrought iron, supporting brake bar.

Two sockets, with coupling screws and clips.

Two couplings.

Two tension rods D.

Two levers.

One cross shaft C, with lever and lever handle B, each with a collar and pin.

The brake bar of channel iron is supported in the wrought iron brackets, which are riveted underneath the trail, and in which it can slide freely in the direction of the length of the trail, but is prevented from moving transversely by wrought iron guide brackets and clips bolted to it at each side of the supporting brackets. To each end of the bar a steel spring is bolted, to the outer end of which a wrought iron shoe is connected by a bolt. The shoe is fitted with a brake block of elm. The sockets fit on the brake bar, outside the supporting brackets, and are secured to it by the clips. A left-handed coupling screw is attached to a loop on the front of each socket by a pin with key. These screws are connected by the couplings with the tension rods, the rear end of which are screwed, and enter the couplings, while the front ends fit on the studs on the lever and lever handle of the cross shaft, and are secured each by a collar and pin. The cross shaft rests in bearings bolted to the outside of the brackets at the breast of the carriage, and passes through the bracket plates. The lever handle is secured on the right end of the shaft, and the lever on the left each by a pin. The lever handle works over a circular rack-plate on the outside of the right bracket, and by drawing it over the rack towards the travelling rear, the elm blocks can be made to press against the tire of the wheels. This brake is only intended for use in travelling; it should be removed when the howitzer is prepared for action.

Roller scotch.

The roller scotch is of sabicu, 9″ long, and 4·75″ diameter. It is hooped with wrought iron at each end, and is fitted with four longitudinal iron plates attached by screws. It has a wrought iron spindle with loop at each end to which is welded a chain with hook. When the roller is required for use one chain is hooked to an eye on the axletree bed, and the other to the loop washer on the end of the arm.

Limber.

The limber is the same as that for the 6·3″ howitzer, and carries the same box when the howitzer forms part of the siege train. When the howitzer is otherwise employed, it carries the same box as the 6·6″ howitzer limber under similar circumstances.

## 6·6″ R.M.L. Gun, Hydro-Pneumatic Carriage.

6.6″ R.M.L. gun hydro-pneumatic carriage. 4568.

The carriage consists of two steel brackets (*a*), connected by a transom (*b*), a wrought-iron trail eye (*c*), and a wrought-iron axletree (*d*).

The brackets are of flanged plate lightened out.

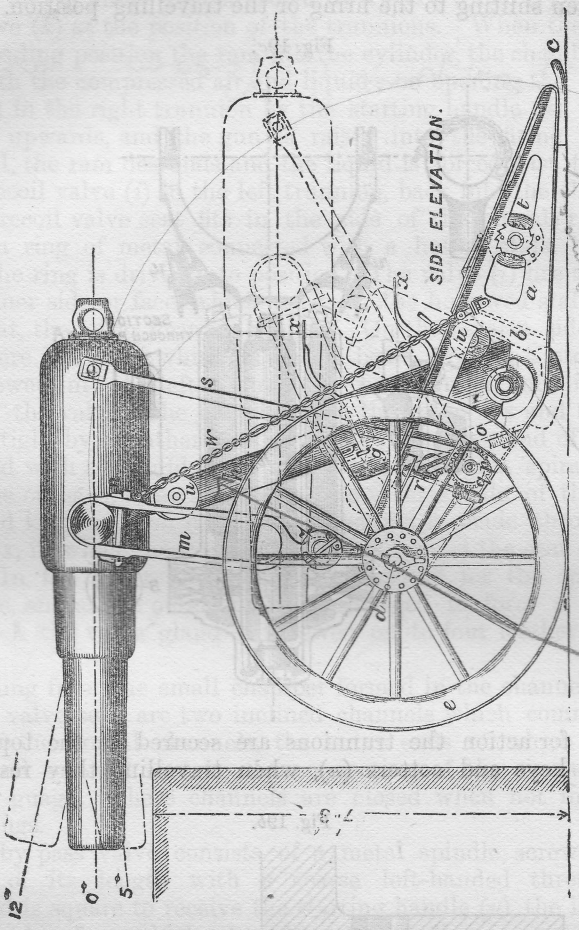



Fig. 19.

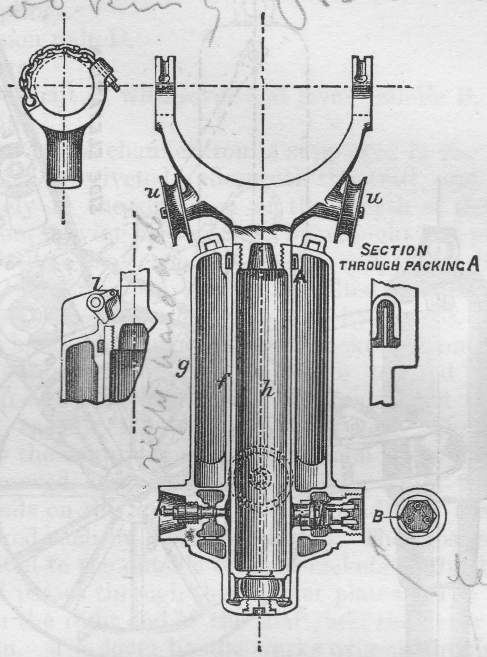
The axletree is formed with flanges, which are riveted to the inside of the brackets.

The wheels for the carriage are No. 5, 1st class B, 6 ft. diameter, with 6″ tires.

A metal cylinder (*g*) fits between the brackets of the carriages, trunnions, formed on it, oscillate in bearings in the brackets. In the cylinder slides a hollow steel ram (*h*) into the upper end of which a steel crutch, which carries the trunnions of the gun, is screwed and secured by pins. The lower end is closed by a wrought iron screw plug, the outer end of which is in the form of a ball enclosed within two wrought iron sockets riveted together over it. These sockets are turned to fit the interior of the cylinder.

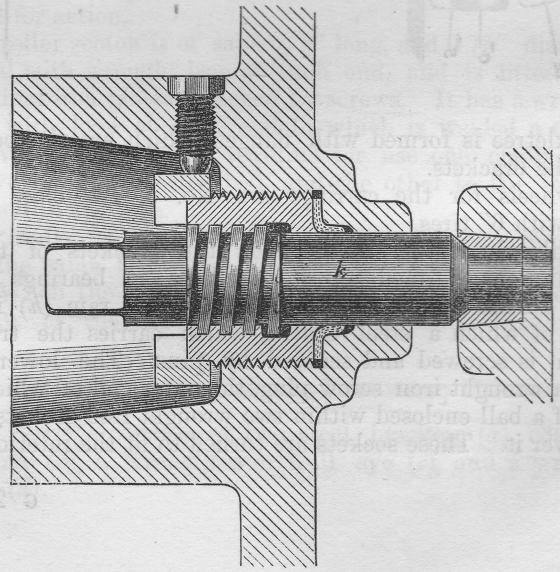
Wrought iron radial arms (*m*) are pivoted to the axletree; they are formed with long slots, in which the trunnions of the gun can slide, when shifting to the firing or the travelling position. When

Fig. 19*a*.




prepared for action the trunnions are secured at the top of the slots by keys and cotters (*n*), when travelling they rest at the bottom.

Fig. 19*b*.



The hydro-pneumatic cylinder consists of an inner cylinder (*f*) and an outer chamber (*g*), formed in one gun metal casting. The chamber and cylinder are connected by a recoil valve (*i*), and a by pass valve (*k*) at the position of the trunnions. When the gun is in the loading position the ram fills the cylinder, the chamber being filled with the compressed air and liquid; on opening the by pass valve (*k*) in the right trunnion by the starting handle (*u*), the ram is forced upwards, and the gun is raised into the firing position. On recoil, the ram descends and the liquid is forced past the non-return recoil valve (*i*) in the left trunnion, back into the chamber.

The recoil valve seat fits in the side of the chamber, it consists of a ring of metal connected with a hollow stalk by three ribs. The ring is driven into position. The valve (*i*) has a spindle on its inner side or face, which works in the hollowed stalk of the valve seat, the latter forming a guide. On the reverse side of the valve there is a stop, which in recoil bears against a stop valve box, screwed into the left trunnion of the cylinder, and limits the travel of the valve. The joint between the valve box and trunnion is made tight by a leather packing ring. The inner end of the box is formed with a shoulder, on which one end of a spiral spring bears, the other end bearing against the reverse side of the recoil valve and keeping it on its seat. A channel is made through the valve box, in which, near its inner end, is formed the seat of a stop valve. In the centre the channel is screwed for the spindle of the valve, and at the outer end it is enlarged to form a chamber into which the valve gland is screwed on to four leather packing rings.

Leading from the small chamber formed in the channel behind the stop valve seat, are two inclined channels which communicate with two horizontal channels, the outer ends of which are enlarged and screwed to take the connection of the air pump and pressure guage. These channels are closed when not in use by screw plugs.

The by pass valve consists of a metal spindle, screwed for a portion of its length with a coarse left-handed thread; the outer end is square to receive the starting handle (*u*), the inner end forms a valve face, which when home closes the passage between the cylinder and the chamber. The valve seat is a metal ring, which is driven into position and can be replaced when worn. The spindle passes through a metal gland, screwed into the gland chamber in the trunnion, and pressing on a leather packing ring at the inner end of the chamber. There is a wrought iron collar on the outer end of the gland, the inner face of which presses against a gutta-percha packing ring. A set screw bears against the wrought-iron collar, and prevents the gland turning when the by pass valve is turned by the starting handle.

A locking pawl attached to the cylinder prevents the ram rising when the gun is travelling or being mounted. The pawl can be secured out of gear by a screw with T handle. There is a filling hole in the top of the cylinder, which is closed by a copper screw plug. A vertical channel 1″ long is drilled up the lower end of

this plug, and a horizontal channel is drilled across it. By partially unscrewing the plug, the pressure in the cylinder can be lowered, the air being allowed to escape by these channels. At the upper end of the cylinder there is a packing chamber, in which is placed a packing ring of U leather, and a notched spring ring of metal.

The carriage is fitted with retaining chains (*w*), elevating gear (*q*), hauling down gear (*t*), wrought-iron steps (*xx*) for laying, and a drag shoe with chain.

The retaining chains (*w*) fixed to the trail, and to the top of the radial arms, prevent the gun being forced too far forward in raising it to the firing position. The lower end of each chain is shackled to an eyebolt, the shank of which fits in an iron socket swivelling in a metal bearing bolted to the carriage brackets. On the shank of the bolt, between the nut and the swivelling socket, are fitted four rings of india-rubber, separated by four iron parting plates. An iron fork is bolted to the trail, in rear of the bearing to prevent the chain fouling in recoil.

**Elevating gear.**

The elevating gear (*q*) consists of two straight racks, which slide in gun metal guides outside the brackets, and gear with pinions on a cross horizontal shaft (*p*), fitted with worm wheel and friction cone.

The worm shaft (*r*) is outside the left bracket, and is worked by a ratchet head and lever.

The racks are attached to the gun by the rods (*s*), and the gear is so arranged that the gun assumes a horizontal position on recoil.

The carriage will admit of 12° elevation and 5° depression over a 7′ 3″ parapet.

**Hauling down gear.**

The hauling down gear consists of a windlass barrel (*t*) between the brackets, four gun metal sheaves (one on each arm of the crutch, one on the front of the cylinder, and one on the transom), two iron levers, and a fall of 5″ white rope, with a hook and thimble spliced on one end. The windlass is fitted with four wheels, and two pawl and two socket rings, each containing four pawls and four sockets. The sockets are intended to take the iron levers, the pawls fall into the teeth of the pawl wheels by their own weight, when above, and each pawl is provided with a stop to prevent its turning back, when below. A pawl attached to each bracket engages the pawl wheel on its side, and prevents the windlass barrel turning back, when the weight is taken off the levers. To ensure these pawls striking together, a wrought-iron frame is hinged on the top of the brackets, in front of the windlass, one side of which when turned to the rear, acts as a stop for the iron levers, when turned to the front, the frame acts as a stop for the cylinder and prevents it striking the sheave on the transom during the dismounting of the gun.

The following will form parts of the "carriage complete."

| | No. |
|---|---|
| Cylinder, hydro-pneumatic .. .. .. | 1 |
| Cylinder, wood, supporting radial arms .. .. | 1 |
| Step, laying, for top of cylinder .. .. .. | 1 |

| | No. |
|---|---|
| Gauge, pressure .. .. .. .. .. | 1 |
| Rope, hauling down .. .. .. .. | 1 |
| Levers, iron, windlass .. .. .. .. | 2 |
| Rods, elevating .. .. .. .. .. | 2 |
| Handles, starting .. .. .. .. .. | 1 |

The limber is similar to that for 40-pr. R.M.L. The limber.

It is fitted to carry the trail and wheel plates, the air pump, and a store box.

### 7-pr. R.M.L. of 200 lbs. Bed.

This bed consists of two brackets of plate iron secured to a bottom plate by outside angle irons, and connected by a transom in front and piece of angle iron in rear. Upon each bracket there are two handles. Weight, 2 cwt. 7-pr. R.M.L. bed. L. of C. § 3038.

The elevating arrangement is a stoolbed (similar to that for mountain service carriages) and hand quoin.

For use the bed is secured by bolts upon a small tee-shaped platform or bed of sabicu.

A hook is fixed on the left bracket, to act as a guide to the lanyard in firing.

22° of elevation can be given, and 5° of depression.

### Forge Wagon and Store Wagon.

These wagons are the same as for field service. Forge and store wagons.

### Platform Wagon.

When this wagon is issued for service with the siege train, it should be fitted to take the 6·6″ R.M.L. gun and 8″ howitzer of 70 cwt. The front bolster should be eased off to suit the chase of the above pieces, and a recess cut in the right side of the wagon frame in rear. Platform wagon. §5034

### 8″ R.M.L. Howitzer of 46 cwt. Carriage and Limber.

This carriage has brackets of double plate construction with wrought-iron frames. The axletree and its bed, which is formed by a piece of angle iron riveted along each side of it, pass through the brackets. A bottom plate extending from the rear transom to the breast of the carriage, connects the brackets below the axletree. 8″ howitzer, 46 cwt. carriage and limber. § 3006

The plates of the brackets are $\frac{5}{16}$″ thick; the rear transom has a forged piece riveted across the top in rear, and both transoms are secured by double angle iron.

The elevating gear is worked at the left side; it is similar to that of the 40-pr., and admits of 40° of elevation being given to the howitzer. When the latter is fired on the carriage, the wheels being on, if the charge is below 6 lbs., the howitzer may have any elevation up to 30°. When the charge is 6 lbs. or over up to 10 lbs., not more than 20° is to be given. L. of C. § 3512.

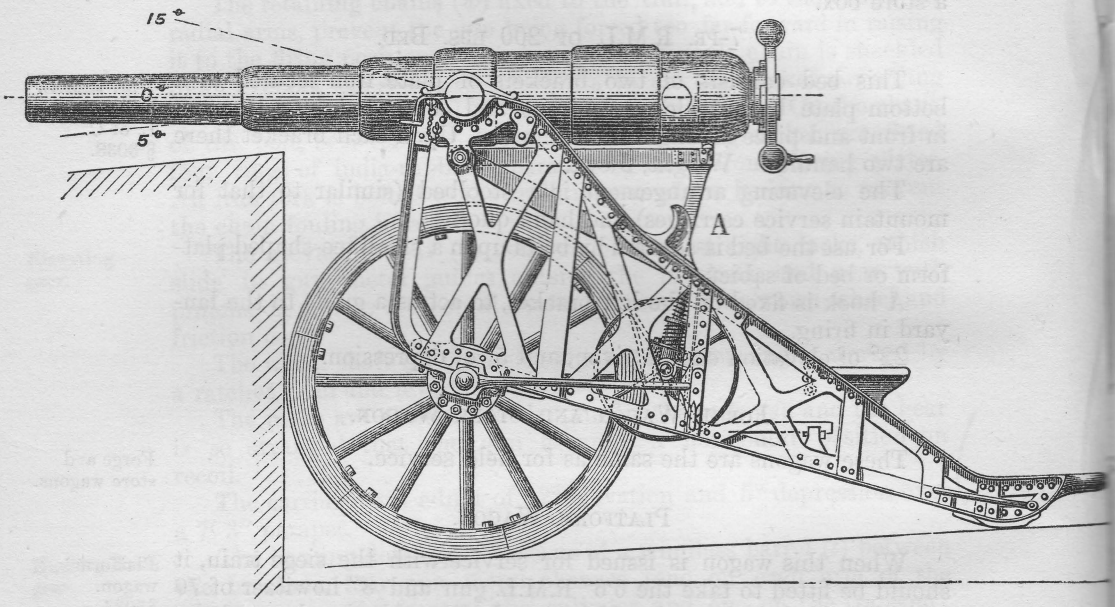
The height of the axis of the trunnion holes is 4′ 8½″. The carriage is not fitted with stoolbed and quoins; the fittings for side-arms, &c., are similar to those of the 40-pr. carriages.

Many of these carriages have been fitted either with or for hydraulic buffers similar to those for the 8″ howitzer of 70 cwt.

The limber is the same as for the 6·3″ howitzer.

40-PR. R.B.L. CARRIAGE FOR 6′ PARAPET.

Fig. 20.




40-pr. R.B.L. carriage for 6″ parapet. § 4407.

The carriage consists of two brackets, trail eye, axletree and wheels.

The brackets are constructed of frames of angle iron, strengthened by bar and plate iron stays, forming lattice girders.

The axletree, which is of square iron with the ends drawn down to form the arms, is held by caps in recesses formed in the lower flanges of the brackets.

Tensile stays, the front ends of which are formed with loops fitting over the axletree arms, join the axletree to the trail.

The brackets are also connected by a diagonal stay at the breast, a transom of steel plate, a second diagonal stay, and a trail eye.

Travelling trunnion bearings are formed by wrought-iron brackets riveted on the inside to the upper flanges of the bracket frames.

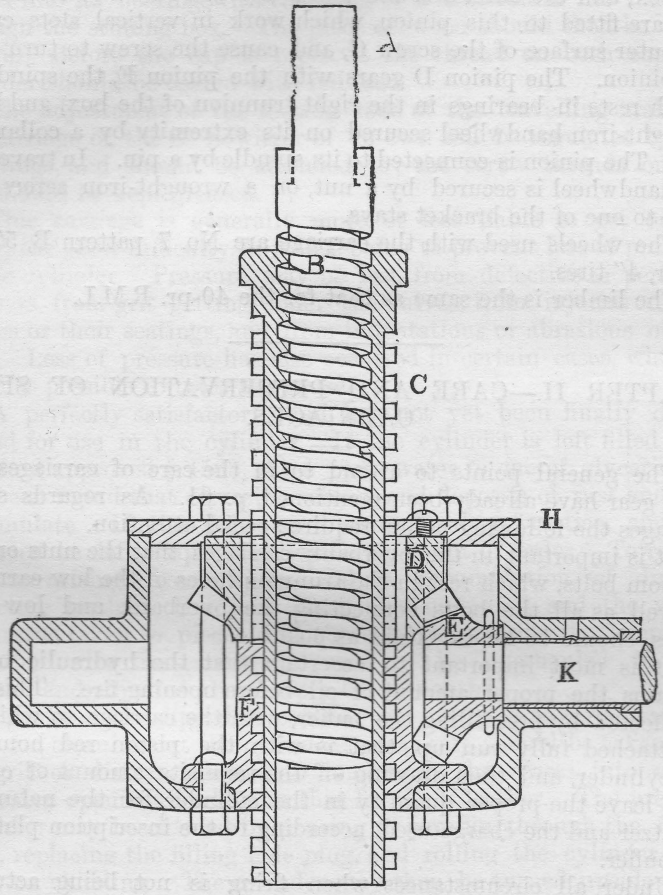
The carriage is fitted with elevating gear, a drag shoe and chain, steps for laying, eyebolts for tackles on the front of the brackets, trail handles, and staples and straps to carry two sponges and rammers, piasaba brush, lever, gun roller and five handspikes.

The elevating gear consists of the following parts :—

A skeleton stoolbed A.

A double elevating screw, consisting of an inner screw B, and an outer screw C.

A box H, with metal nut F.




A metal pinion D, 18 teeth, 5·5″ diameter.
A metal pinion E, 11 teeth, 3·375″ diameter, with spindle K, and handwheel.

The skeleton stoolbed is formed of four wrought-iron bars riveted together, it pivots at the front on bolts passing through the carriage brackets, and is connected at its lower end in rear by a bolt, to the head of the inner screw B.

The gun rests on a pad formed on the upper end of the stoolbed in rear. The inner screw B is wrought-iron, 2″ diameter, the thread is left-handed, ·625″ pitch. The outer screw C is also wrought-iron, 3″ diameter, the thread is right-handed, ·625″ pitch. The outer screw C works in the metal nut F, which is riveted to the bottom of the box H. The box is wrought-iron, it is formed with hollow trunnions, which oscillate in two metal bearings, one bolted to the front of the transom, and the other to the right bracket. A lid is secured on top of the box by four bolts.

The metal pinion D is supported on top of the nut F inside

the box, and the outer screw C passes through it. Two feathers of P.B. are fitted to this pinion, which work in vertical slots cut in the outer surface of the screw C, and cause the screw to turn with the pinion. The pinion D gears with the pinion E, the spindle of which rests in bearings in the right trunnion of the box, and has a wrought-iron handwheel secured on its extremity by a collar and nut. The pinion is connected to its spindle by a pin. In travelling the handwheel is secured by a nut, on a wrought-iron screw stud fixed to one of the bracket stays.

The wheels used with the carriage are No. 7, pattern B, 5′ diameter, 4″ tires.

The limber is the same as that for the 40-pr. R.M.L.

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## CHAPTER II.—CARE AND PRESERVATION OF SIEGE CARRIAGES.

The general points to attend to in the care of carriages and their gear have already been mentioned, p. 61. As regards siege carriages the following points require special attention.

Overbank carriages.

It is important in the overbank carriages that the nuts on the transom bolts, which rest in the trunnion holes of the low carriage, as well as all the bolts connecting the overbank and low carriages, should be kept as tight as possible.

Hydraulic buffers.

It is most important to ascertain that the hydraulic buffer contains the proper amount of oil before opening fire. This can be effected by first filling the buffer, with the carriage to which it is attached fully run up, that is with the piston rod home in the cylinder, and then drawing off the requisite amount of oil, so as to leave the proper quantity in the cylinder, for the nature of howitzer and the charge used, according to the inscription plate on the buffer.

Under all circumstances when firing is not being actually carried on, the buffer should always be kept full of oil, and the piston should be home. The rod should always be kept clean.

If it is required at any time to remove the piston and rod from the cylinder, the rear cap must be taken off, but the front one must not be disturbed. The buffer should be removed from the carriage, and lashed down securely on skidding, the rear cap warmed with a hot iron and then unscrewed by the spanner, placed on the hexagon on its end. The shackle should be taken off the piston rod, and the packing gland slackened, when the piston and rod may be removed. The piston should be received by hand as it leaves the cylinder, and before the rod quits its bearing in the front cap, a small block of wood should be placed in the cylinder to receive it.

To replace the piston and rod, the rod should be supported in the cylinder on a small block of wood with a piece of string attached to it, which will raise the rod to the height of its bearing in the front cap, the rod may then be pushed up the cylinder to the front cap, and while it is being forced forward from the rear,

prised into its bearing with the tang of a half-round file inserted through the stuffing box. The piece of wood should then be withdrawn. Before the cap is replaced the thread on both cap and cylinder should be coated with red lead.

Brake carriage R.M.L. 8″ howitzer, 70 cwt.

The adjustment of the tension rods of the travelling brake on the carriage of the 8″ howitzer of 70 cwt. can be regulated by the couplings, and should be attended to; the screw threads on the rod should be kept greased.

The H.P. carriage.

This carriage is generally more or less liable to get out of order, the great difficulty in its use being to prevent loss of pressure in the cylinder. Pressure may be lost from defective or perished leathers, from grit getting under the valves, from injuries to the valves or their seatings, and from indentations or abrasions of the ram. Loss of pressure has also occurred in certain cases, where it was not possible to trace the cause.

A perfectly satisfactory fluid has not yet been finally determined for use in the cylinder. If the cylinder is left filled with the fluid approved § 4568, three parts water to one of glycerine, it has been found that corrosion sets in, and deposits of rust and dirt accumulate. If the fluid be drawn off after practice, and the cylinder be left empty, the leathers get out of order. To rectify defects arising from injured valves, accumulation of dirt or defective leathers, the gun must be dismounted and the whole apparatus taken to pieces and thoroughly washed. To keep it in working order the carriage requires to be overhauled in this manner and adjusted about every three months.

Washing cylinder.

Sponge cloths dipped in paraffin, and attached to a rod, may be used for cleaning out the cylinder; great care should be taken that no grit or dirt is allowed to remain in the recess into which the valve openings lead, or in that for the U leather. The pressure chamber may be cleaned by pouring in paraffin, through the filling hole, replacing the filling hole plug, and rolling the cylinder carefully on skidding. The cylinder may then be turned upside down the filling hole plug removed, and the paraffin allowed to drain out; while in this position the valves may be removed and cleaned.

To charge the cylinder.

Remove the filling hole plug, rest the gallon measure in the hole, turn off the cock, and fill the measure to the gallon mark with the authorised fluid. Turn the cock and allow the fluid to flow into the cylinder. Repeat the operation until the quantity required is run in. This quantity is about $10\frac{3}{4}$ gallons, but cannot be laid down exactly as the cylinders are rough castings. The surface of the fluid should be about $16\frac{1}{2}$″ below the filling hole, when the gun is fully down in the loading position. Remove the measure, and replace the filling hole plug. See that the ram is down in the cylinder and locked by the pawl, and that the by pass valve is closed. See that the stop valve in the left trunnion of the cylinder is securely closed. Remove the two metal plugs in the left trunnion of the cylinder and secure one end of the copper connecting pipe to one of the holes and the other to the air pump, and secure the pressure gauge pipe in the other hole. Open the stop valve, and pump in air, until the required pressure is reached.

Close the valve, remove the pipe and pressure guage, and insert the screw plugs. By letting the pump stand in water, water instead of air can be forced into the cylinder; by lowering the water in the cistern below the level of the pump cylinders, and removing the large plunger, any fluid poured into the large pump cylinder can be forced into the H.P. cylinder of the carriage, by means of the small pump.

**The ram.** The ram should be kept clean and lubricated. It is especially desirable to guard against dirt or grit accumulating on its surface and being carried down with it into the cylinder where it might injure the U-leather or get under the valves. The surface should be wiped over, if possible, immediately before firing.

The joint of the plug at the base of the ram must be made as tight as possible, and the plug must bear firmly on its seat, or there will be leakage into the ram, and consequent loss of pressure in the cylinder. This plug is screwed home by the hexagon plug key and the starting handle of the by pass valve. At the top of the cylinder at the rear of the opening for the ram, there is a removable piece of metal which supports the ram at the commencement of recoil. Should the face of this piece become much worn in firing it should be removed and replaced

**Valve seatings.** The seating of the recoil valve can be driven out, if necessary; the seating of the by pass valve must be bored out. Both seatings, especially that for the by pass valve, require grinding occasionally. Should it be necessary, the valve and seating should be worked, as far as possible, with a file, after which the valve may be worked in its seat with fine sand. If no fine sand is available, fine emery may be used.

**By pass valve.** The lever handle should be worked with care; the valve should be pressed home or withdrawn from its seat, with gentleness, to prevent injury to the seating.

**The U leather and other packings.** The U leather can be removed, by first drawing one end of the metal ring towards the centre of the cylinder, and running something smooth between it and the edge of the recess, at the same time pressing it towards the bottom of the cylinder, when it will clear the recess. The leather can then be taken out by pressing it in the direction of the bottom of the cylinder until it is clear of the recess, when it may be withdrawn without injury to its edges. Should the ring be in any way damaged or perished it must be replaced. A new ring should be well dubbed before it is put in, and in putting it in, the inside of the U may be filled with tallow. When in use the U leather, as well as all the other leather packings should be dubbed occasionally.

The gutta-percha ring for the iron collar of the by pass valve, should be slightly warmed before it is put in.

**Radial arms.** The nut on the stay connecting the radial arms should be kept very tight. The spanner for the nuts has a socket to take the iron levers of the windlass, which should be used in tightening them.

**Air pump (for description see p. 105).** The cistern of the air pump should always be kept filled with water above the level of the top of the pump cylinders in order to

preserve the packing of the plungers. Before working the pump the metal cap should be taken off the lubricating cup T, Fig. 24*a* p. 105, the cup filled with oil, and the cap replaced.

No dirt, mud or grit should be allowed to accumulate during working on the wire gauze S, through which air is drawn into the pump.

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## CHAPTER III.—GROUND PLATFORMS AND MISCELLANEOUS ARTICLES FOR SIEGE SERVICE.

The platforms for the present siege train, are Clerk's and the double decked.

The following platforms are also included under the designation of "siege," although the mountings for which they are intended, no longer form part of the siege train.

R.B.L. 7″.

R.M.L. howitzers 8″, 6·6″ and 6·3″ beds.

### Clerk's Platform. Mark II.

Clerk's platform. Mark II. L. of C. § 3513.

This platform consists of two inclined planes having a slope of 3°, four transoms, and a trail plank.

The inclined planes are each fitted on their inner sides with a riband plated with iron along its inner edge; a movable iron stop in front and rear to keep the wheel from running off; a plate round the thin end, with a hole for the pivot pin; at the rear a traversing bolt.

Three of the transoms are 7′ long, and the fourth 10′. Two of the short transoms are laid under the front of the inclined planes, and the third 6′ 6″ in rear of them, the long transom under the rear of the planes. For the 25-pr. carriage the third short transom is only 5′ 6″ in rear of those in front.

The first transom has four holes for the pivot pins, the two inner holes for the 40-pr. and the 6·3″ howitzer, the two outer for the 25-pr.

The trail plank is of oak, 8′ long; it is plated with iron on the upper surface for a length of 3′ from the front; it is laid with its front end resting on the third short transom.

To lay the platform the transoms are bedded flush with the ground at right angles to the line of fire. The gun being then run into position, the wheels are raised in succession, and the inclined planes run under them and pivoted to the front transom. The trail plank is then placed under the trail.

The platform can be used for a standing or rear chock carriage by pivoting the inclined planes sufficiently near to each other, and in this case the trail plank is not required. For the rear chock carriage the inclined planes are placed with the ribands on the outer sides.

For transport the parts are lashed together.

§ 4138. Rope handles have been added to the trail plank. They are formed of $2\frac{1}{2}''$ tarred rope, passed through two horizontal holes at 6″ from the front and rear ends of the plank, and secured with a knot at each end.

§ 4506. The following alterations and additions will be embodied in future manufacture of platforms of the above nature and will be applied to the exising store (§§ 3513 and 4138) as may be ordered from time to time.

Each shoe plate to be increased in thickness to $\frac{3}{16}''$, and and in length to 8′ feet on the upper, and 4′ on the lower surface of the inclined plane. The shoe plate to be secured by rivets instead of screws; six short iron plates being provided for the rivets, which pass through the plane beyond the end of the shoe plate on the under side.

The side plates to be also secured to the ribands by rivets instead of screws.

The trail plank to be strengthened by the addition on each side of an iron plate 3 feet by 4 inches by $\frac{1}{2}''$ secured by rivets.

| | cwts. |
|---|---|
| Weight .. .. .. .. .. .. | $17\frac{1}{2}$ |
| | tons. |
| Tonnage.. .. .. .. .. .. | 1·6 |

## Clerk's Platform. Mark I.

Clerk's platform Mark I. This platform, not having been found strong enough for R.M.L. guns, has now been superseded for future manufacture by Mark II, from which it differs in the following points:—

It has two sleepers and two transoms instead of four transoms; one transom is laid under the front of the inclined planes, the other under the rear, and the sleepers are laid at equal distances between the transoms.

The trail plank is of fir, longer, and is not plated with iron.

## § 4224. Platform, Wood, Siege, Ground, Double-Decked "C" Pivot.

A drawing of this platform has been sealed to govern supplies.

The platform consists of two layers of 3″ fir planks, those for the bottom layer parallel to the line of fire, those of the upper layer at right angles to it; under the bottom layer are placed four transverse planks, similarly to those in the top layer, one at the front, another at the rear of the platform; the other two dividing the distance between them. The layers are connected by 5″ coach screws through both ends of all the transverse planks. A circular cast steel pivot plate, fitted with a pivoted socket, is securely bolted to the platform near the front, and the hydraulic buffer of siege carriages is connected to the pivoted socket by the trunnions of the cylinder. The pivot plate also forms the wheel guide, and by dispensing with the anchoring apparatus, enables a large angle of traverse to be obtained.

By the substitution of a radial arm for the pivoted socket the pivot plate becomes suitable for use with the 4″ and 5″ B.L. siege carriages (p. 499).

One platform consists of:—

Bottom layer 16 planks, 18′ × 9″ × 3″
Top layer 24 „ } 12′ × 9″ × 3″.
Transverse planks 4 }
48 5″ coach screws, $\frac{5}{8}$″ diameter.
8 9″ „ „ „
2 hurters, 3′ × 6″ × 6″.

Almost any scantling may be used for hurters.

Any of the siege train howitzers mounted on travelling carriages, or siege guns on overbank carriages may be fired from this platform but it is more especially intended for the howitzers, mounted on travelling siege carriages, fitted with hydraulic buffers.

The average weight of double-decked platforms is about 35 cwts.

They will be carried and laid by the Royal Engineers.

## 7″ R.B.L. Platform (page 211).

This platform was intended to take the 7″ R.B.L. gun mounted on a naval carriage and converted slide, page 353, when used for siege service.

## Ground Platform for R.M.L. Howitzer Beds.*

This platform consists of four oak baulks, lying side by side, and housed into front and rear transoms, so that the upper surfaces of all are flush. The outside baulks are also secured by bolts which are fastened by round flush nuts on the top of the platform. Iron plates $\frac{1}{2}$″ thick are let into the baulks, and secured by rivets.

Ground platform for howitzer beds. L. of C. §§ 3137 and 3495.

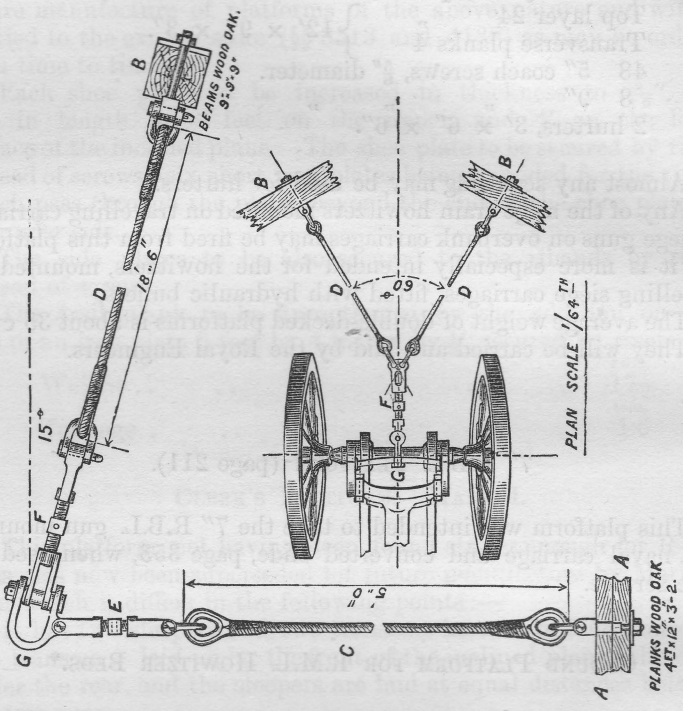
In the front transom is a pivot, the shank of which passes down through the transom; it is held in a metal socket, which is secured by four bolts also passing through the transom; these bolts and the shank of the pivot are keyed on a plate underneath the platform.

A rack-plate of corrugated iron is let into the rear transom and secured by rivets to prevent the handspikes slipping when traversing the guide bar. At the middle of the length of the platform a strap of iron passes underneath, the ends being turned up and secured to the outer baulks by screw loops.

The platform is used for the beds both of the 8″ and 6·3″ howitzers. It will admit of either bed being traversed 5° to the right or left.

* This is now only used in permanent works. Two of them are joined together, with a widening piece in the centre, to increase the angle of traverse.

Fig. 22.




Apparatus, anchoring carriage, H.P. 6·6″ R.M.L. § 4568.

The apparatus consists of the following parts:—

Two planks A, A, 4′ × 12″ × 3″ each, fitted with eyebolts, shackles, pin keys, nut and washer.

Two beams B, B, fitted similarly to the planks.

Steel wire rope C, length 5′.

Two steel wire ropes D, D, length 18′ 6″.

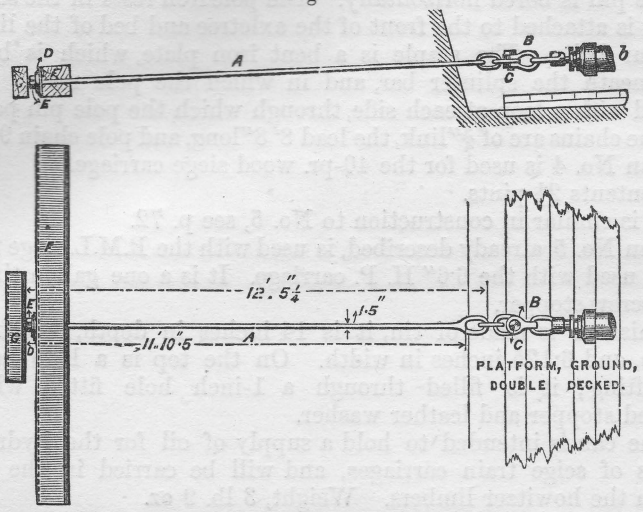
Two wrought-iron coupling screws E, F, with couplings, shackles, pins and keys.

A wrought-iron axletree band G, with bolt, collars and keys.

A steel tommy is issued with the apparatus.

In laying the anchorage, the planks A, A, are bolted together to form a cross, and sunk in the ground vertically under the centre of the axletree. The band G fits over the axletree at its centre, and is connected with the planks A, A, by the coupling screw E, and the wire rope C. The band is also connected by the screw F and wire rope D, D, with the beams B, B, which are sunk in the ground at equal distances from the axletree, so that the wire ropes meet at an angle of 60° at the centre of the coupling, and are inclined at an angle of 15° to the horizontal plane.

Fig. 23.




The apparatus consists of the following parts:—

Apparatus, anchoring carriage siege, with buffer. § 4430.

A wrought-iron tie rod with links A.
A wrought-iron connecting shackle B.
A steel bolt C with key.
A wrought-iron plate D and nut E.
A beam of oak F, 10′ × 9″ × 9″.
A beam of oak G, 3′ × 9″ × 4″.

The apparatus is for use in siege batteries, with siege carriages fitted with hydraulic buffer. The tie rod passes through the beam F, and is secured by the plate D, and the nut E. The tie rod is connected by means of the bolt and shackle and the links at its rear end with the piston rod B of the buffer. The beam G is placed as shown in the diagram in front of the end of the tie rod.

In laying the anchorage, which would necessarily have to be done in constructing the battery, the 10′ oak beam should be laid at such a depth that the tie rod, when shackled up, will be parallel with the upper surface of the platform (generally laid at a slope of 1 in 24), and at such distance from the interior slope of the parapet that the eye of the tie rod will just be clear inside the revetment, and so be in a convenient position for shackling up. It is essential that the position of the shackle should be such that its bolt will be vertical, so as to admit of lateral play when traversing in the process of laying the howitzer. The height of the shackle from the level of the platform, will depend upon the height of the axis of the hydraulic buffer, as shown in the diagram. It should be about 1″ less than the height of this axis.*

Bullock draught.

The fittings for bullock draught for siege service are generally similar to those for field, p. 71.

The pole is 10′ 3″ long, and is considerably stronger. The hole

* This apparatus has now been superseded by the central pivot, described with the double-decked platform.

for the pin is bored horizontally. The pole iron rests in the socket, which is attached to the front of the axletree and bed of the limber by four bolts. The staple is a bent iron plate, which is bolted underneath the splinter bar, and in which the pole rests. It is formed with a loop at each side, through which the pole pin passes.

The chains are of $\frac{3}{4}$″ link, the lead 8′ 8″ long, and pole chain 9′ 10″.

Can lubricating.

Can No. 4 is used for the 40-pr. wood siege carriage.

Contents $2\frac{1}{2}$ pints.

It is similar in construction to No. 5, see p. 72.

Can No. 5, already described, is used with the R.M.L. siege train.

Can, glycerine.

Is used with the 6·6″ H. P. carriage. It is a one gallon tin can with screw stopper.

Can, oil, 2 gallons, R.M.L. howitzer, siege train. § 5,100.

This can is made of tin, it is 14 inches in depth, 8 inches in length, and 6·125 inches in width. On the top is a loop handle for lifting; it is filled through a 1-inch hole fitted with a screwed stopper and leather washer.

The can is intended to hold a supply of oil for the hydraulic buffers of seige train carriages, and will be carried in the store box on the howitzer limbers. Weight, 3 lb. 9 oz.

Caps, sponge.

*Vide* p. 339.

Case, vent-piece. R.B.L. 40-pr.

Cases for carrying 40-pr. R.B.L., spare vent pieces upon the limbers are made of strong leather.

Chains, drag, shoe.

The chains for siege service are as follows:—

| Number in Series. | Total length. | Diameter of link. |
|---|---|---|
| | ft. in. | in. |
| No. 1. R.B.L. 40-pr. 6 ft. parapet, R.M.L. howitzers and 40-pr. .. .. .. .. .. | 9 3 | $\frac{3}{4}$ |
| No. 2. Wood 40-pr. R.B.L. .. .. .. .. | 9 $7\frac{1}{2}$ | $\frac{3}{4}$ |
| No. 3. H. P. 6·6″ R.M.L. .. .. .. .. | 9 11 | $\frac{3}{4}$ |
| No. 8. 8″ mortar.. .. .. .. .. .. | — | — |
| No. 9. Platform wagon .. .. .. .. .. | 8 7 | $\frac{11}{16}$ |

Coins.

These have been placed in two numbered series, under the respective designation of coins, carriage, and coins, hand. The following are the coins for siege service.

Coin, carriage, No. 5, 20″ × 9″ × $6\frac{1}{2}$″ for R.M.L. iron siege carriages.

Coin, hand, No. 6, 14″ × $5\frac{1}{2}$″ × 4″.

Coin, hand, small, No. 7, 10″ × 3″ × 3″.

Coins are wedge-shaped pieces of sabicu. The carriage coins have a shallow recess cut in two sides of the wedge; the hand coins are fitted with a handle at the base.

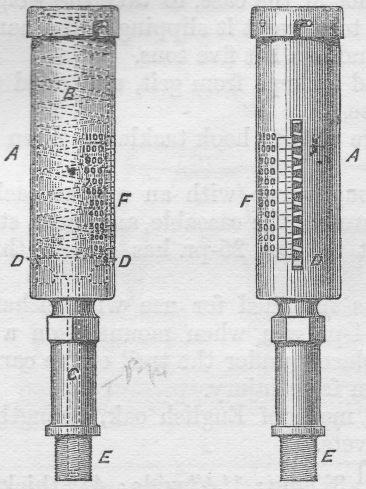
Cover, vent slot, R.B.L. 40-pr. side-closing.

This is a waterpoof canvas cover made sufficiently large to pass over the breech of the gun, with a pocket lined with leather for covering the projection on its side. It is secured to the breech by three 1″ straps.

Guage pressure, R.M.L. 6·6′ gun H.P. carriage.

The gauge consists of a metal cylinder (A) fitted with a spiral spring (B) and a small steel ram (C), with a leather packing ring; between the ram and spring are pointers (D) sliding in slots in the cylinder.

Fig. 24.




The gauge when required is connected to the hydro-pneumatic cylinder by the screw (E), when the pressure in the cylinder (B) is indicated by the pointers (D) on the graduated scales (F). The screw (E) is protected when not in use by a metal cap.

The case is of leather, fitted with a cap, secured by a strap and buckle; a metal inscription plate is attached to the side.

Guides whee § 4435.

These guides are for use with siege carriages fitted with hydraulic buffers on double-decked ground platforms. Two guides are issued with each platform.

Each guide consists of an elm plank, $3\frac{1}{2}''$ thick, cut in the form of a segment of a circle, and shod with a half inch iron plate, attached by four rivets on the curved edge.

Weight of each, 1 qr. 15 lbs.

Each wheel guide is attached to the platform by four 9″ galvanized iron coach screws.

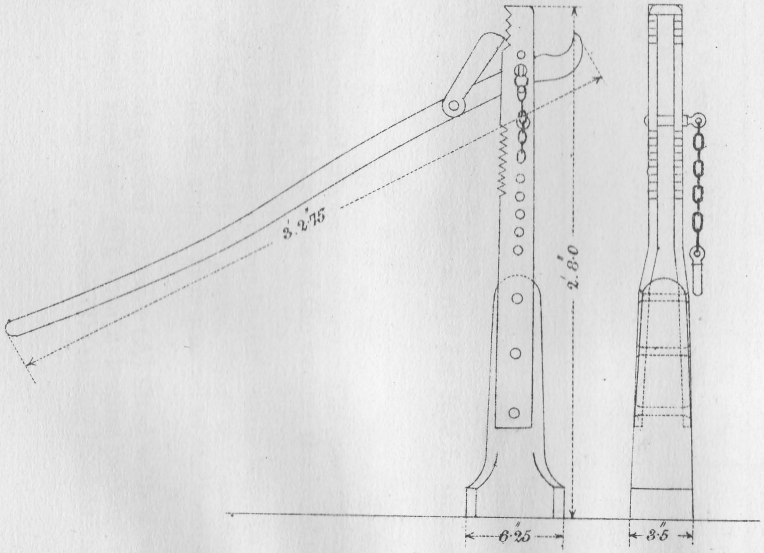
Weight of each screw 1 lb. 6 ozs.

Jack, lifting.

The lifting jack used for siege service is the common screw jack, Plate XXIII. It consists of a screw working in a metal nut fixed upon the top of a cast-iron case or pedestal. The screw is fitted with a ratchet head, a slot in the latter passing over a feather in the former. Above the head a ratchet collar is attached by a bolt to a ring placed round the screw, and secured to it by a pin working in a groove. The ratchet collar, underneath, at the side opposite to that at which it is attached to the ring, has four teeth, and projecting from it, at the same side, an arm over which a lever handle fits. When the lever handle is at right angles to the screw the teeth of the collar gear in the ratchet head, and the screw must then turn with the handle; but when the handle is raised the teeth of the collar rise above the ratchet head, so that, when in this position the handle is turned, it does not affect the screw, and a fresh purchase can be taken. The head of the screw is constructed

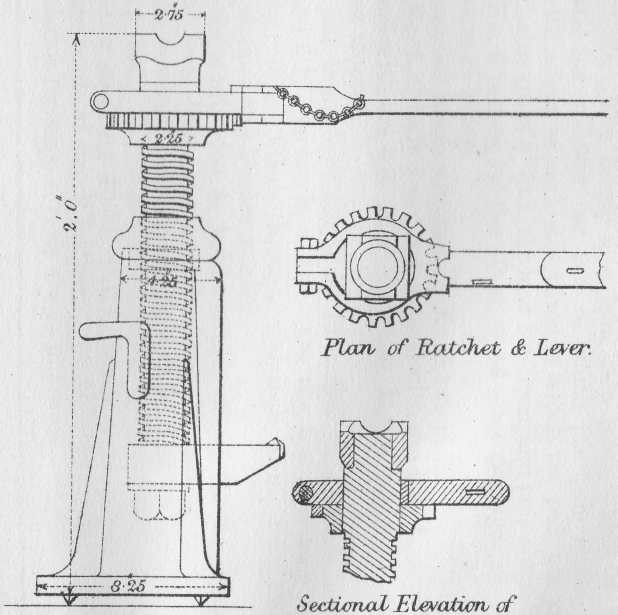
## COMMON LIFTING JACK.

*Scale about* $\frac{1}{12}$




## SCREW LIFTING JACK.

*Scale about* $\frac{1}{8}$.




*Plan of Ratchet & Lever.*

*Sectional Elevation of Head of Screw, Ratchet & Collar.*

*To face page 103.*

Plate XXIII

12447.

DANGERFIELD LITH. 22 BEDFORD ST COVENT GARDEN.

to take the bearing of the weight; there is also a lifting jaw projecting through a slot in the case, to take the weight if low. The jack has three feet to prevent it slipping, and a handle to lift it by; it weighs 64 lbs., and can lift five tons.

The head should be kept from grit, and oiled through the hole in it for the purpose.

Loops, breech. L. of C., § 3516.

Breech loops are used to hook tackle to when shifting on overbank carriages.

They are of wrought-iron, with an eye at each end. That for the 40-pr. passes through the cascable, and has a stud to prevent its going too far; that for the 25-pr. has a hole, through which the cascable passes.

Plank, trail. Mark I. § 3439.

This plank was intended for use with either the 8″ R.M.L. howitzers, or the 64-pr. gun, when mounted on a travelling siege carriage. It was placed under the trail of the carriage to preserve the ground platform from injury.

The plank was made of English oak, strengthened by an iron plate secured by rivets.

Size, including iron plate } 3′ long; 1′ 4″ wide; 4½″ thick.

Weight, 1 cwt. 1 qr.

Plank, trail. Mark II. § 4435.

This plank supersedes Mark I for use with siege carriages fitted with hydraulic buffer, on double-decked ground platforms. It is made of oak 6′ × 12″ × 3″, shod on both sides for the whole of its length with channel steel, and fitted with four rope handles.

Weight 2 cwts. 1 qr. 7 lbs.

Plates, iron, ground. siege Mark I. § 4568.

Three plates are used when firing with the hydro-pneumatic carriage R.M.L. 6·6″ gun. One is placed under each wheel and one under the trail. The edges and corners are rounded off.

Dimensions, 3′ × 2′ × 1″.

Weight, set of 3, 6 cwts. 1 qr. 8 lbs.

Tonnage, ·037 tons.

Plate, steel, wheel, platform, siege. § 4435.

These plates are for use with siege carriages, fitted with hydraulic buffer on double-decked ground platform. A plate is placed under each wheel of the carriage.

Dimensions, 18″ × ½″ × 6′.

Weight, each, 1 cwt. 2 qrs. 10 lbs.

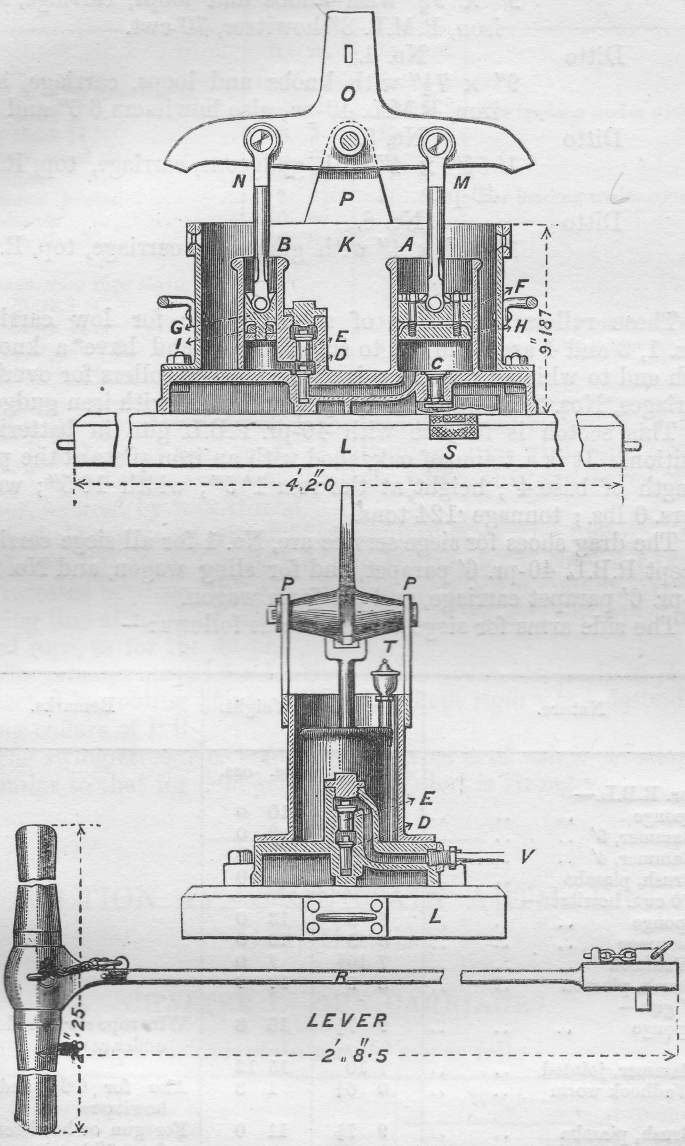
Pump, air, R.M.L. gun, 6·6″ HP. § 4568.

An air pump is issued with each carriage for charging the cylinder. It consists of two gun metal cylinders (A, B), with solid plungers (F, G) having leather packings (H, I). The cylinders are in one casting, and are connected by passages with valves (C, D, E). They are surrounded by a wrought-iron cistern (K), the whole being fixed on an oak plank (L) forming a base. The plungers (F, G) are connected by rods (M, N) to a cross head (O), oscillating sufficiently in the bearings (P, P) to give the required stroke. The cross head is fitted to receive a removable lever (R). (S) is a wire gauze, through which air or water is taken into the pump; (T) a lubricating arrangement, and (V) the pipe by which the pump is connected to the H. P. cylinder.

Weight (complete), 1 cwt. 3 qrs.

Tonnage, 0·249 tons.

Fig. 24*a*.




These rollers are used for shifting siege guns and howitzers from travelling to firing trunnion holes. They have been arranged in the following numbered series :— Rollers, wood, shifting. § 4500.

Roller, wood, shifting No. 1.

11″ × 5″ with knobs and loops, carriage, siege, wood, R.B.L. 40-pr.

Ditto No. 2.

1′ 3⅞″ × 4″ with gudgeons, carriage, siege, iron R.B.L. 40-pr., 6′ parapet.

Roller, wood, shifting, No. 3.
9″ × 9½″ with knobs and loops, carriage, siege, iron, R.M.L. 8″ howitzer, 70 cwt.

Ditto No. 4.
9″ × 7½″ with knobs and loops, carriage, siege. iron, R.M.L. 40-pr., also howitzers 6·6″ and 6·3″.

Ditto No. 5.
1′ 5⅝″ × 4″ with gudgeons, carriage, top, R.M.L. 40-pr.

Ditto No. 6.
1′ 0¾″ × 4″ with gudgeons, carriage, top, R.M.L. 25-pr.

These rollers are made of sabicu, those for low carriages, Nos. 1, 3 and 4 are hollowed to suit the gun, and have a knob at each end to which a rope loop is spliced. The rollers for overbank carriages, Nos. 2, 5 and 6, are hooped and fitted with iron gudgeons.

Scotch, recoil. § 3258. This scotch is for use with 40-pr. R.B.L. gun in batteries of position. It is a frame of oak, shod with an iron plate at the point. Length of base 4′; height at the rear 1′ 5″; width 10·5″; weight 3 qrs. 0 lbs.; tonnage ·124 tons.

Shoes, drag. The drag shoes for siege service are, No. 1 for all siege carriages, except R.B.L. 40-pr. 6′ parapet, and for sling wagon, and No. 2 for 40-pr. 6′ parapet carriage, and platform wagon.

Side arms. The side arms for siege service are as follows:—

| | Nature. | Length. | Weight. | Remarks. |
|---|---|---|---|---|
| | | ft. in. | lbs. ozs. | |
| | 40-pr. R.B.L.— | | | |
| | Sponge .. .. .. | — | 10 0 | |
| | Rammer, 5′ .. .. .. | — | 9 0 | |
| | Rammer, 4′ .. .. .. | — | 8 0 | |
| | Brush, piasaba .. .. | — | 10 0 | |
| | 8″ 70 cwt. howitzer— | | | |
| § 4015. | Sponge .. .. .. | 8 9 | 13 0 | |
| § 4013. | Rammer .. .. .. | 8 9 | 13 8 | |
| § 4017. | Wadhook .. .. .. | 7 10¾ | 7 0 | |
| | Brush, piasaba .. .. | 8 9 | 10 8 | |
| | 6·6″ gun— | | | |
| § 4169. | Sponge .. .. .. | 9 7½ | 15 8 | Wire rope stave for loading under cover. |
| ,, | Rammer, jointed .. .. | 7 10 | 15 12 | |
| ,, | Wadhook worm .. .. | 0 6¼ | 1 8 | Also for 6·6″ and 6·6″ howitzers. |
| § 4346. | Brush, piasaba .. .. | 9 7½ | 11 0 | For gun or howitzers and for 6·3″ howitzer. |
| | 6·6″ howitzer— | | | |
| § 4096. | Sponge .. .. .. | 8 0 | 8 8 | |
| ,, | Rammer .. .. .. | 6 9½ | 9 0 | |
| ,, | Wadhook worm .. .. | 0 6¼ | 1 8 | Also for 6·6″ and 6·3″ howitzers. |
| § 4346. | Brush, piasaba .. .. | — | 9 8 | For gun or howitzer. |
| | 6·3″ howitzer— | | | |
| § 3286, | Sponge, with rammer head .. | 5 0 | 10 4 | Fitted for worm. |
| § 3532. | Wadhook worm .. .. | 0 6¼ | 1 8 | Also for 6·6″ gun and howitzer. |
| § 4346. | Brush, piasaba .. .. | — | 8 0 | |

| Nature. | Length. | Weight. | Remarks. | |
|---|---|---|---|---|
| | ft. in. | lbs. ozs. | | |
| 40-pr.— | | | | § 3479. |
| Sponge, wire rope staves, | | | | |
| Mark I .. .. .. | 10 3 | 10 13 | For loading under cover. | |
| Mark II .. .. .. | 10 3 | 15 0 | | § 2699. |
| Sponge, wood stave .. .. | 10 0 | 8 8 | | |
| Rammer .. .. .. | 9 6½ | 7 8 | | ,, |
| Rammer, jointed .. .. | 7 5¼ | 11 8 | For loading under cover. | § 3479. |
| Wadhook .. .. .. | 10 0 | 8 0 | | § 2699. |
| Brush, piasaba .. .. | 10 0 | 6 12 | | |
| 25-pr.— | | | | § 3479. |
| Sponge, wire rope stave, | | | | |
| Mark I .. .. .. | 8 10 | 8 13 | | |
| Mark II .. .. .. | 8 10 | 12 12 | For loading under cover. | |
| Rammer, jointed .. .. | 6 2¼ | 10 8 | For loading under cover. | § 3479. |
| Brush, piasaba .. .. | 8 8⅜ | 6 0 | | |

The sponge staves Mark I, for loading under cover, 25-pr. and 40-pr. R.M.L. guns were made of galvanised iron wire rope, served with ½″ tarred rope, except at the ends, where they are served with leather, secured by wax thread.

Mark II are made with 2·5″ galvanised steel wire rope.

The sponge stave for the 6·6″ gun is also of 2·5″ steel wire rope. The recesses between the wire strands are filled by winding tarred quilting line along them, and the stave is afterwards served with ½″ tarred rope, as for the 40-pr.

The rammer staves for loading under cover, are made in pieces connected by folding joints, which are kept rigid when desired by sliding collars of P.B.

The swingletree No. 1 for siege service is of ash 2′ 4″ long, it is similar to that for field service (p. 75) but is stronger. Swingletree.

## SECTION IV.—MOUNTAIN ARTILLERY CARRIAGES.

### CHAPTER I.—GUN CARRIAGES.

The carriages for mountain service are as follows:—

| Nature. | Weight. | | Tonnage with wheels. |
|---|---|---|---|
| | Without wheels. | With wheels. | |
| | lbs. | lbs. | tons. |
| R.M.L. 7-pr., 200 lbs. .. .. .. .. | 206 | 350 | ·443 |
| R.M.L. 7-pr. 200 lbs., India pattern .. .. | — | — | — |
| R.M.L. 7-pr. 150 lbs. .. .. .. .. | 180 | 306 | ·415 |
| R.M.L. 2·5″ Mark I .. .. .. .. | 292 | 484 | ·506 |
| R.M.L. 2·5″ Mark II .. .. .. .. | 324 | 539 | ·506 |
| Limber, R.M.L. 7-pr. 200 lbs. .. .. .. | — | 382 | — |

R.C.D. photo-litho-graphs, 1A, 1C, and 1D.

The first gun carriages for the 7-pr. were constructed of wood; they had wheels with wood naves and the "common cross-handled" elevating screw.

The next carriages were for the steel gun of 150 lbs. for service in Abyssinia; they were constructed with steel brackets attached to a wooden transom, and had a steel axletree, wheels with wood naves, and the common cross-handled elevating screw.*

The present carriages are as follows:—

### 7-PR. R.M.L. GUN CARRIAGE, MARK I, FOR THE STEEL GUN OF 200 LBS.

7-pr. 200 lbs. steel, carriage. L. of C., § 3473. Pl. XXIV.

This carriage consists of two brackets, two transoms, a trail piece, axletree, and wheels.

The brackets are of plate iron, with pieces cut out to diminish the weight, they are strengthened by a piece of angle iron riveted along the upper edge. They are parallel from the breast to the second transom, from which they rapidly converge towards the point. The trail piece is similar to that of the 9-pr. R.M.L. carriage, except for Indian service, when the eye is rectangular. The bracket plates are recessed to receive the axletree, and pieces of angle iron are riveted round the recesses to form bearings for it.

Bearing pieces of angle iron are riveted to the point of the trail.

The axletree and wheels are of the special class. The former is solid, and its arms are 7″ in length, without lead or hollow; it is secured to the brackets by clips. The wheels have a track of 2′ 3″.

The carriage is fitted with a stool bed of tee-iron (see Plate XXIV), so formed in front as to hang loosely on a cross-bar between the brackets, while in rear it has two studs, one at each side, which rest in racks riveted to the brackets. By this arrangement the slope of the bed, and consequently, the elevation of the gun, can be very considerably varied. A sliding coin is attached to the stool bed by clips; it is worked by a screw which is held in a bearing in the end of the stool bed, and enters a nut in the coin, the screw is turned by a hand wheel.

A check rope (2″ white rope) with loop and toggle at each end is issued with the carriage; when not in use it is carried strapped inside the right bracket near the point.

The sponge is similar to that of the 9-pr. R.M.L., but shorter.

The height of the axis of the trunnion holes is 2′ $1\frac{3}{4}$″.

The carriage forms a load for one mule, and the wheels for another.

### LIMBER, MARK I, FOR THE 7-PR. R.M.L. OF 200 LBS., STEEL.

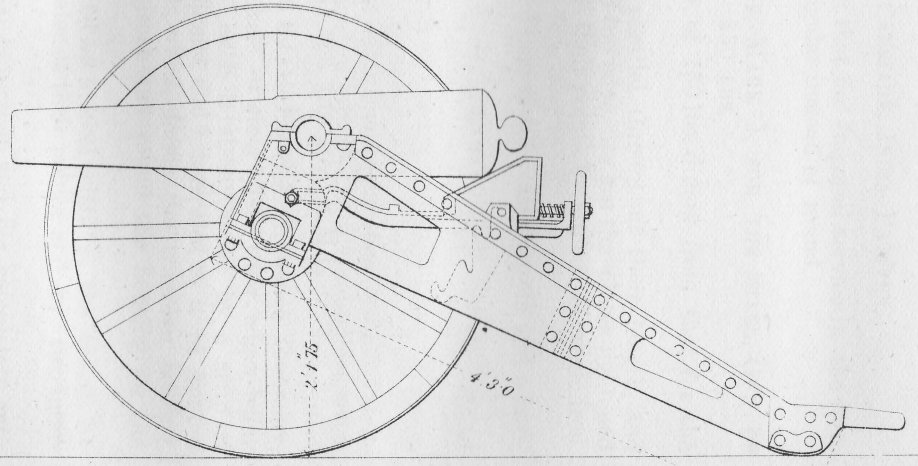
7-pr. limber, Mark I.

The limber for use, when practicable, with the preceding carriage is constructed as follows:—The frame is of angle iron with a futchell of tee-iron; it is attached to the axletree by stays of plate iron riveted one to each side of the frame and to a lug on the axletree. Upon the rear of the frame a small limber hook is

* Some iron carriages of simple construction and limbers were made for the $4\frac{2}{5}$″ S.B. howitzer or the ·45 Gatling, also two special for the Gatling, for service on the coast of Africa, the latter had 2′ 6″ wheels with a 2′ 1″ track, the former 3′ 0″ wheels with 2′ 4″ track. The limber was similar to the 7-pr. limber, but fitted for man draught; for the Gatling it carried steel-plated boxes holding two drums each.

# CARRIAGE FOR 7 Pr R.M.L. STEEL GUN OF 200 LBS.

*Scale $\frac{1}{15}^{th}$ full size.*




*To face page 108.*

Plate XXIV

12443

DANGERFIELD. LITH. 22. BEDFORD ST COVENT GARDEN.

riveted, and upon the front irons for two light Brandling shafts in single draught.

The wheels are the same as for the gun carriage, and have the same track as the latter.

The limber carries two mountain service ammunition boxes, either for common or for double shell, which are secured to box staples in a platform plate across the centre of the frame, and to staples for straps on the front and rear of the latter.

A grease tin is carried strapped to the axletree.

### 7-pr. 200 lbs. Carriage, India Pattern.

7-pr. 200 lbs. carriage, India pattern.

This carriage differs from that for Imperial service in the form of the trail eye being rectangular instead of round.

### 7-pr. R.M.L. Gun Carriage, Mark I, for the Steel Gun of 150 lbs.

7-pr. 150 lbs. steel, carriage.

The carriage for the 7-pr. of 150 lbs. differs from that for the 200 lbs. gun as follows :—

The brackets are nearly parallel throughout their length, and have no angle iron along the top edge, nor are the plates lightened out. They are connected at their points by a piece of angle iron, and by the trail plate which laps over them.

The trail eye is oblong. There is only one transom and a horizontal stay.

The wheels are 2′ 6″ in diameter, and the height of the axis of the trunnions 1′ 10″.

The carriage with its wheels (removed from the axletree) forms a load for one mule.

### Carriage (Mark I) for the 2·5″ R.M.L. Gun.

Carriage for 2·5″ R.M.L. gun in two pieces. § 3808.

This carriage, constructed by the Elswick Ordnance Company, consists of two parallel brackets of steel plate, their edges being turned out to form flanges. Each is strengthened by a strip of angle iron under the upper flange, and has riveted to it in front a metal piece of angle section, which forms the trunnion bearing, and also extends down the front and round the housing for the axletree.

The brackets are connected by a steel plate at the breast, by another lapping over and under at their points, and by two intermediate transoms.

The axletree is rectangular in section, and fits completely into the housings in the brackets, where it is retained by a plate under each bracket. Each plate is held by two bolts, one at each end, that at the rear end passing through a slot cut for it in the plate, so that when the nuts of the bolts are slackened, the plate can be turned to the front and the axle released. The axle is reversible.

The elevating gear is of similar design to that of the other mountain carriages, but the racks are longer, and differently placed,

and the sliding quoin or wedge is of metal instead of wood; a movable wood block fits on the quoin, and is secured by a key.

There is a fixed square loop for a traversing hand spike, and also a shoe and pin.

The sponge stave is made in two pieces, connected by a screw joint; loops screw on to the joints by which the portions of the stave are attached to hooks on the tops of the brackets near the point, the rammer head and sponge portions of the stave rest in metal sockets shaped to receive them, and are secured by straps.

§ 5084. The rammer head is formed by a hollow metal cylinder, and is fitted with a nut for a wadhook worm. The latest pattern (Mark II) has an enlarged recess in the head.

The carriage has fittings for a sledge hammer and turnscrew. It has also two check ropes of $2\frac{1}{4}$″ white rope, fitted with a loop at one end and a toggle at the other.

The body of the carriage, with side arms, weighs 192 lbs., and forms a load for one mule; the wheels weigh 192 lbs., and form a load for a second mule; the axletree weighs 84 lbs., and the elevating gear 36 lbs., and these, with the cascable block, the hammer, and other stores belonging to the gun, make a load for a third mule, estimated weight 200 lbs.

The tonnage with axletree is ·619 ton, and without, ·506 ton.

### Carriage R.M.L. 2·5″, Mark II.

Carriage, R.M.L. 2·5″ Mark II. Plate XXV.

This carriage is similar in general design to the Mark I, differing principally in the following particulars:—

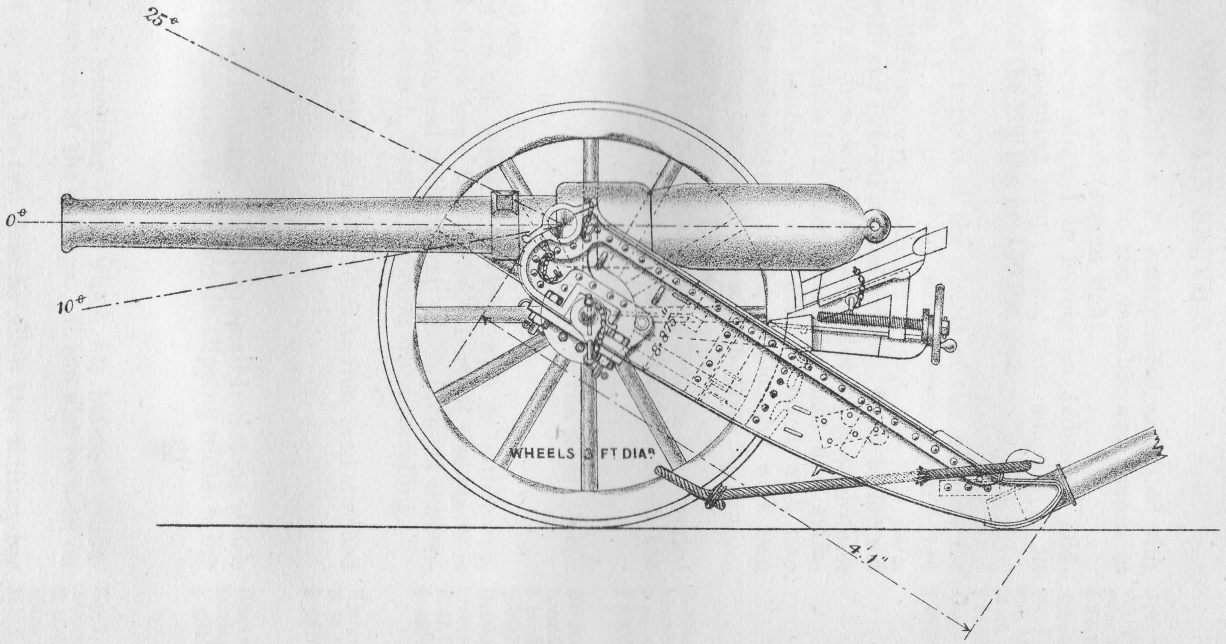
The shoe plate, with part of the socket for the traversing handspike, is in one forging of steel; a metal hook is riveted to the shoe plate for the check rope, which is prevented from fraying when in use by metal friction pieces riveted to the brackets; the rear transom is fixed horizontally, and fitted with guide pieces for the dismounting block; the bearings for the trunnions and axletree are of malleable cast steel instead of metal, and there are no fittings for the sponge and rammer.

Fittings for carrying the check ropes, a half round grease tin, a worm wadhook, the priming irons, and two spanners for securing the axletree clips, are fixed to the trail.

The wheels (3′ diameter, $2\frac{3}{8}$″ tire), No. 67, are similar to those for Mark I carriage, with the exception of the tires, which are $\frac{1}{4}$″ thicker, and rounded on the top.

Elevation, 25°
Depression, 15°

# CARRIAGE, 2·5 INCH, R.M.L. MARK II.




To face page 110.

Plate XXV.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 12452.

## CHAPTER II.—MISCELLANEOUS ARTICLES FOR MOUNTAIN SERVICE.

Apron, canvas, 200-lbs. gun, Mark I. § 3473.

The apron is of canvas, 11″ × 6″, waterproofed, and fitted with two straps, by which it is secured to the cascable and breech of the gun, to protect the vent and tangent sight.

Apron, canvas, 7-pr. 200 and 150 lbs. Mark II. § 3829.

This apron differs from Mark I in having an additional fold-under each end of the securing strap; being thus adapted to fit the cascable of either the 200 lbs. or 150 lbs. gun.

Arms, wheel. § 3473.

Wheel arms, for the support of the wheels of the carriage for the 7-pr. steel gun of 200 lbs. when carried upon a mule, are "near" and "off," differing only in the set to suit the side bars, and can be used with any general service saddle. Each is formed of a hollow cylinder of iron, with wood shoulder collar projecting from an iron plate, to which it is fixed; both the plate and cylinder are covered with leather, and the latter is fitted with two straps with links for attachment to the saddle, and with two smaller straps for securing the wheel and a girth strap.

The weight of a pair of arms is 12 lbs.

Bearer, breech, 7-pr. 200 lbs. § 3473.

The bearer for lifting the 7-pr. steel gun of 200 lbs. is a rounded bar of ash 4′ 8″ long, having a crutch at the centre to fit on the cascable, to which it is secured by a pin.

Weight 4 lbs. 6 ozs.

Bearer, breech, 7-pr. 150 lbs. § 3831.

This differs from that of the 200 lbs. gun in the form of the central metal bearing, which is ·75″ deeper.

Weight 5 lbs. 6 ozs.

Bearer, breech, R.M.L. 2·5″. § 4916.

This consists of an ash stave, 2′ 9″ long, with a leather cap, fixed by a metal flange near the centre. Part of the stave is covered with collar cloth, and with the cap which protects the connecting screw of the breech, forms a tampeon when travelling.

Weight 4 lbs.

Bearer, chase, R.M.L. 2·5″. § 4916.

This is a bar of ash, which passes through an iron band attached to the cap joint chase.

Length 5′ 6″.

Weight 6½ lbs.

Bearer, carriage, 2·5″. § 4916.

This is a bar of ash, furnished with two small iron stops, which fit on each side of the carriage to prevent it slipping while being lifted to the cradle.

Length 5′ 6″.

Weight 7 lbs.

Block, dismounting, R.M.L. 2·5″. Mark II. M.C.I. for Mark II. carriage. § 4916.

The block has a triangular base, which fits between guide-pieces on the rear transom of the carriage. It can also be used on the ground.

The upper part, or cup, has two slots to allow the shifting-bar to pass through the cascable, so as to prevent the breech moving during the operation of connecting or disconnecting the gun.

Weight 6¼ lbs.

Boxes, ammunition.

Two leather boxes, Punjaub pattern, Mark II, are sealed for the

7 pr. 200 lbs. § 3473.

7-pr. steel gun of 200 lbs., one for common and the other for double shell. The box for the common shell is bound with iron and the lid is attached by copper hinges and fastened by straps and buckles. The interior of the box is covered by a flap, and divided by leather partitions to carry shells, cartridges, and fuzes, eight rounds, the shells held in leather cylinders, and the cartridges contained in a waterproof canvas cartouch. The box is fitted with a carrying strap, which secures the lid at each end, with links for attachment to the saddle, and with nib irons and a staple for strap to secure it on the limber. When packed upon a mule it can be opened without taking it off the mule's back, and the lid when let down supplies a table for use in boring and fixing fuzes. The weight of the box (fitted for limber), empty, with cartouch, is 24½ lbs., and packed 88 lbs. The box for the double shell is similar; it carries shell, cartridges, and fuzes for five rounds, and weighs empty, with its cartouch, 30½ lbs., and packed 95 lbs. Mark I boxes differed from these in not being fitted with nib irons, in having different carrying straps, and higher cylinders for the shell. The box for double shell opened also in a different way.

Boxes, ammunition, 2·5″, near, off. § 4916.

These are similar to the ammunition boxes for the 7-pr. 200 lbs. The end of each box is fitted with a leather handle, and the bottom with two iron loops (without links), by which it is attached to the cradle. The lid is fitted with three metal hinges, and is fastened by two iron hasps and turnbuckles. There are no side straps. The interior is divided by two leather partitions, and is fitted with leather cylinders to carry 8 rounds of ammunition.

Dimensions, 22″ long, 12″ wide, 10″ deep.

Weight { "Near," 23 lbs. / "Off," 24½ lbs.

Boxes, ammunition, Clarkson's, R.M.L. 2·5″ near, off.

These boxes are made of Clarkson's material, covered with leather. The lid, which has a handle on the top, is hinged by the leather and canvas coverings, and fastened by two hasps and turnbuckles.

The box, which is carried on the axletree cradle, has two leather chapes, with 1½″ Dees for hanging it by, and two leather ⅞″ straps riveted on the ends, by which it is buckled to the cradle to keep it steady; two metal chafing-pieces are riveted to the back.

It is fitted internally with a strap and loop for the gas ring, four leather cylinders for case shot, and for four cartridges in canvas cartouch.

Dimensions, 20¼″ long, 7″ wide, and 8⅛″ deep.

Weight 9 lbs.

Box, artificers, Clarkson's. § 4916.

This box is made of Clarkson's material. It is fitted externally with a handle at each end; internally it has a leather bag for a vice, or large stores.

Dimensions, 29¾″ long, 11½″ wide, 15¾″ deep.

Weight 25½ lbs.

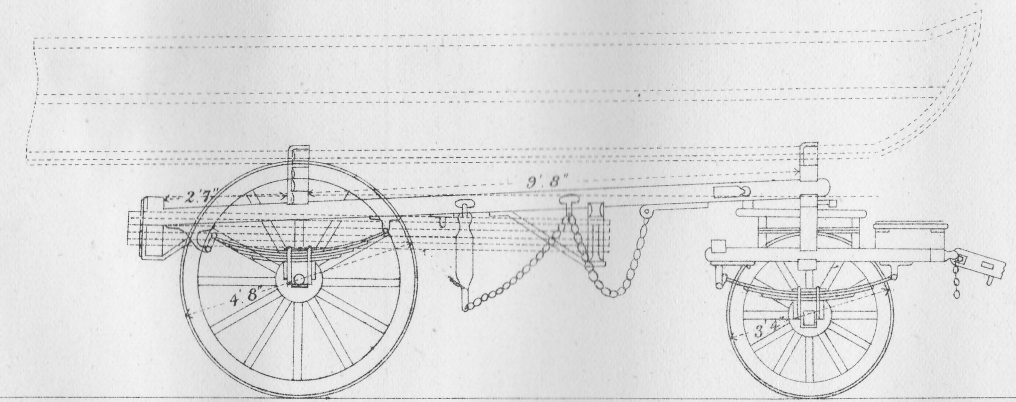
Boxes, fuze.

The boxes for mountain service are No. 4 percussion R.L. for 12 R.M.L. 7-pr. 200 lbs. and 150 lbs.

# WAGON, PONTOON, WITH BOX COMPLETE.

## MARK III.

*Scale $\frac{1}{48}^{th}$ full size.*




To face page 122.



DANGERFIELD. LITH. 22 BEDFORD ST. COVENT GARDEN.

No. 5 percussion R.L. for 6 R.M.L. 2·5″.

No. 4 has already been mentioned, p. 70.

No. 5 is similar, but the lid is secured by only one clip.

Box, ammunition, wood, 2·5″ R.M.L. § 4916.

This box, of teak, is fitted with two iron turnbuckles, and two iron nibs for securing it to the wheel cradle. The lid, covered with canvas, has two iron strap hinges, and is fastened with a hasp and turnbuckle. It carries 3 star shell and 3 cartridges.

Dimensions, 16¾″ long, 10″ wide, 5″ deep.

Weight, 12 lbs.

Boxes, small store, 7-pr. 200 lbs. near, off.

There are two leather boxes sealed for carrying small stores, percussion fuzes, tubes and shell implements for the 7-pr., viz., "off" and "near," Mark I, differing only in the internal fittings. Each is fitted with links, two handles and has the lid secured by two straps.

Dimensions (internal), length, 18″; width, 6½″; depth at front, 6½″; depth at back, 7″.

Box, sundries, R.M.L. 2·5″ tin.

This is a rectangular box, with hinged lid fitted with handle, and secured by a hook.

Dimensions, 6¾″ × 5½″ × 6¾″.

Breechings, pack saddle, R.M.L. 2·5″.

The breeching is similar to the breast collar, but it has a chain piece at each end to prevent chafing. The loin strap which passes through a loop on the crupper, is 1¼″ wide, and 40″ long.

Can, lubricating, R.M.L. 2·5″.

No. 8, R.M.L., 2·5″, ½-pint.

Similar to those for field service (p. 71).

Cap, joint, chase, R.M.L. 2·5″.

The cap is made of leather, with an iron loop for bearer. It fits over the end of the chase to protect the joint screw. It is secured by two ¾″ straps with metal studs.

Weight, 1½ lbs.

Collar, breast, pack saddle, R.M.L. 2·5″.

The collar is of "seat hide," folded in three, with a leather chape sewn at each end for the iron D and chains by which it is attached to the cradle. Two leather tugs with buckles are sewn on the front for the neck strap, which is a plain 1″ strap, 34″ long.

Cover, trunnion sight, R.M.L. 2·5″.

This cover is intended to protect the sights while travelling, It is made of canvas with two circular holes, edged with leather, which pass over the trunnions, and three straps, with buckles, by which it is secured.

Cover, vent, R.M.L. 2·5″.

This cover is of leather, 9½″ × 7″. It is furnished with two ¾″ straps and buckles, by which it is fastened round the breech to protect the vent.

Weight, 8 ozs.

Cover, vent, R.M.L. 7-pr. 200 lbs. and 150 lbs.

This cover is of waterproof canvas, 11″ × 6″, pleated at one edge to suit the form of the breech of the gun, and fitted with two straps at one side and two buckles at the other.

Cover, 6′ × 6′ G.S. Mark II. §§ 4274, 4905.

These covers are of waterproofed canvas. They have five brass eyelet holes on each side, and 21 feet of 1½″ tarred rope lashing is issued with each.

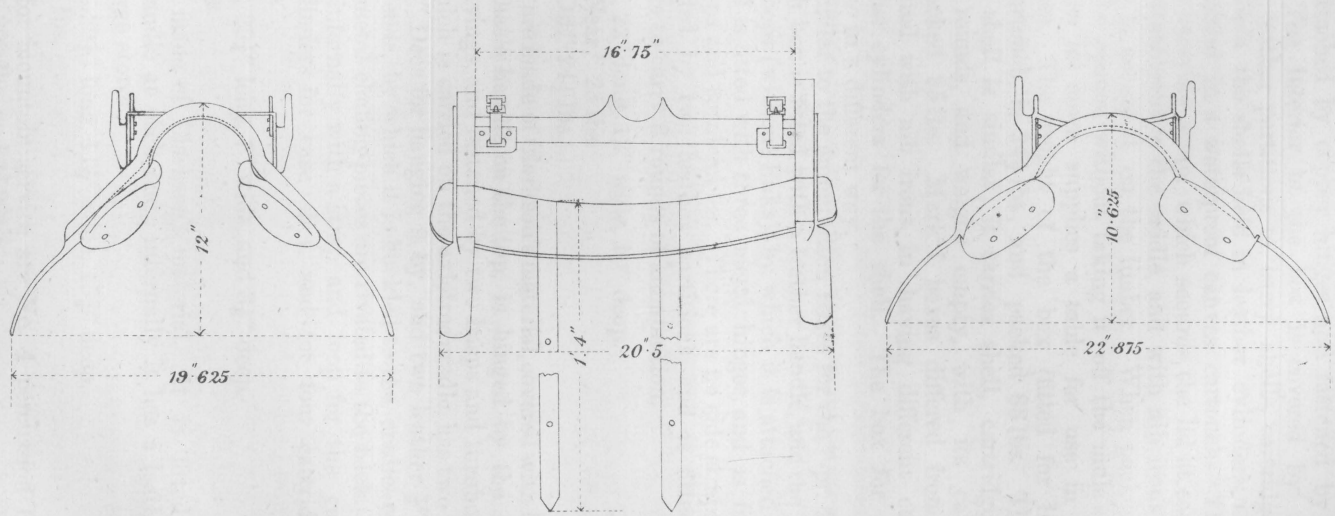
Cradles, L. of C. § 3466.

There are two iron cradles sealed for the 7-pr. of 200 lbs., one to carry the gun and the other the carriage. The wheels are

# CRADLE, IRON, WITH SADDLE-TREE FOR CARRYING CARRIAGE.

## 7 P^R R. M. L 200 LBS. GUN.

*Scale ½ full size.*




12449.

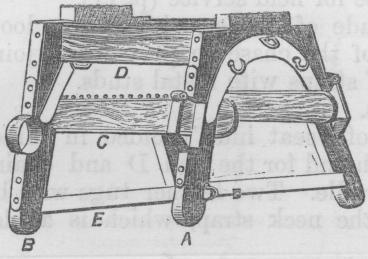
DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

carried upon wheel arms on a third mule. Each cradle is riveted to the angle iron arches of the saddletrees (which are the same as those described, L. of C., clause 2639, but without hinged side bars), and consists of a simple framework of iron. The cradle for the gun is rather narrower than that for the carriage; the gun rests in it, muzzle to the rear, the trunnions fitting in recesses upon the sides of the frame, and being secured by two straps. The cradle for the carriage is similar to that for the gun; the carriage rests upon it, breast to the front and is secured by straps, the lower ends of the elevating racks bearing upon the recesses in the sides of the frame. The gun cradle with saddletrees weighs 16 lbs. 6 ozs., the carriage cradle Mark I with saddletrees, 16 lbs., and the carriage cradle Mark II with saddletrees, 17 lbs.; the latter differs from the previous in being longer, the front arch narrower, height increased, and carriage moved more to front.

Cradles, 2·5″. Equipment. § 4904.

There are six patterns of cradles for this equipment for the carriage, axletree, wheels, breech and chase of gun and ammunition boxes respectively. They are generally similar in construction but differ in their fittings and the manner in which they are adapted to carry their different loads.

Fig. 25.




Each cradle consists of a front A and back B, two side bars C, C, two top bars D, D, all of mahogany and two side stays E, E, of steel.

The top bars are tenoned and bolted to the front and back. Each has one hole in the centre for a strap with toggle, which is buckled to a surcingle.

The connection between the top bars and ends is strengthened by arch plates attached to the front and back, both on the inside and the outside by rivets. Three hooks are formed on the outside ends of the rivets in front; and two hooks, and a staple for the metre strap, in rear. The inside arch plates have knees formed on them by which they are attached to the underside of the top side bars by screws and rivets

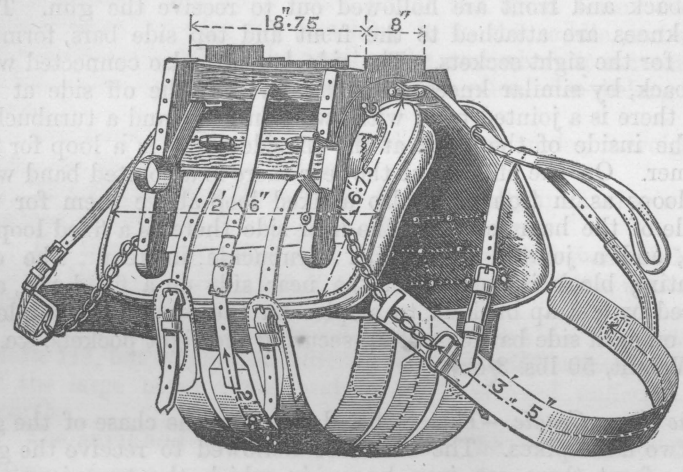
The side bars are housed into the back and front, and are secured by two screws at each end. They are rounded at the

ends to suit the pockets of the pannels. Each bar has two holes for straps with toggles, which are buckled to the girths.

The steel bars are attached to the back and front by one screw and one rivet at each end. A ramshorn hook is riveted at each end of these bars.

A wide strip of leather fits over the side bars, and is attached to them by screws.

Fig. 25*a*.




*The Carriage Cradle.*—This cradle is fitted to take the carriage and a bearer at each side. The back and front are strengthened by a binder of iron plate at the top. Staples for securing straps are fitted to the knees of the arch plates. At each side, there is a jointed band in rear with hasp and turnbuckle, and a loop band in front, for the bearers.

Weight, 43 lbs. 11 ozs.

*Axletree Cradle.*—This is fitted to carry the axletree, two Clarkson's ammunition boxes, wadhook worm, grease tin, and trunnion ring. The axletree lies lengthwise on top of the cradle, a nib iron on each band fitting in a hole in the axle to steady it in travelling. The ammunition boxes are secured, one at each side, to staples fixed to the ends of the cradle, at the position of the steel side bars. The wadhook worm is carried on top of the leather strip where it is secured by a leather loop and strap. The grease tin is strapped to two staples on the off side. A block for the trunnion collar hooped with iron is attached to the near top side bar by screws.

Weight 48 lbs. 11 ozs.

*The Wheel Cradle.*—This is fitted to carry the wheels and elevating gear. Each end of the cradle is covered at the sides and top by an iron binder having hooks for the wheels; the sides and

hooks are covered with leather. A small cross stay with hole in it between the side bars receives one of the studs of the stoolbed of the elevating gear which is further secured by two straps and chapes, buckled over all.

Weight 47 lbs. 4 ozs.

NOTE.—The fittings for the implement box, which was formerly carried on this cradle, are not removed.

*The Breech Cradle.*—This carries the breech of the gun, the breech-bar, sponge, trunnion hammer, and dismounting block. The back and front are hollowed out to receive the gun. Two iron knees are attached to the front and top side bars, forming stops for the sight sockets. The side bars are also connected with the back, by similar knees, with staples. On the off side at the front there is a jointed band with two iron loops and a turnbuckle. On the inside of the front at the off side there is a loop for the hammer. On the off side at the rear there is a jointed band with two loops as in front, and also a fixed loop above them for the handle of the hammer. On the near side there is a fixed loop in front, and a jointed band with turnbuckle in rear. The dismounting block is carried on the near side on a fixed pin, and secured by a strap buckled to staples on the cradle. A staple is fixed on each side bar for a strap securing the sight pockets, &c.

Weight, 50 lbs. 3 ozs.

*The Chase Cradle.*—This is fitted to carry the chase of the gun and two handspikes. The ends are hollowed to receive the gun. At the front there are iron knees, in which the trunnions rest. There is a curved stay attached to the top side bars just in rear of the front to keep the trunnion collar steady in travelling. On each side there is a jointed band in rear and a loop in front to carry the handspikes. A staple is fixed on each side bar for a strap securing the sight pockets, &c.

Weight, 46 lbs. 11 ozs.

*Ammunition Cradle.*—The ends are protected by iron binders, formed with hooks at each side at the top. The cradle will either carry two ammunition boxes, the packsaddle forge and anvil, the entrenching tool rack, or two Clarkson's artificers' boxes. Two cross rails are fixed on the top by which a spare axletree can be carried.

Weight, 44 lbs. 15 ozs.

Cruppers, packsaddle, R.M.L. 2′ 5″.

This is an ordinary leather crupper, buckled on to a metre strap, which is secured to the cradle by a wooden toggle.

Forge, Mark I. L. of C., § 1570.

This forge consists of a rectangular iron tray, 25·5″ × 19·375″, supported upon four jointed iron legs, which are kept in position by sliding connecting bars. The tray is deepened out at one end to form the hearth, and fitted with a movable cast-iron back plate for the fire. The bellows are fixed underneath the tray to the connecting bars of the legs, and have a goose-neck shaped nozzle

reaching upwards to the blast hole in the back plate; they are connected by a bar to a crank which when the blast is required is worked by a lever handle. A tool box of wood with canvas-covered lid hangs upon one side of the tray. To pack the forge upon a mule the tool box is removed, the back plate, nozzle, &c., taken off and strapped upon the top of the bellows. The forge is then turned upside down, the bellows made to slide upon the hearth, the legs folded, and the whole bound together by two straps for the purpose, when it can be hung by links at one side of the tray, upon the saddle.

The anvil and anvil block are of the usual form; the latter has links at one edge for attaching it to the saddle, and a recess in one side into which the anvil packs, and where it is retained by a pin. A 7 lb. hammer, a poker and a slice, also belong to the forge.

The forge complete forms a load for one mule; it weighs 217 lbs., and its tonnage is ·182 ton.

Forge, pack saddle, mountain, and R.E. Mark II. L. of C., § 3475.

This forge differs from Mark I principally in having a blower instead of bellows.

The hearth, back, and legs are the same as those of Mark I, except that a folding guard is hinged to the back, and folding stays are added to steady the legs.

The blower is the same as that described for the field forge Mark III, but smaller, and driven by a toothed handwheel in place of the large bevel wheel and lever; it is fixed underneath the hearth.

The anvil and block, tools, &c., are the same as for Mark I forge.

Weight, 119 lbs.; tonnage, ·101 ton.

Forge, pack saddle, Mark III.

In this forge, Fig. 26, the blast is given by a Baker's blower, as in Mark II, the hearth, blower, and driving gear being modified, so as to render the forge very much more efficient, and at the same time to reduce the weight to 106 lbs.

The forge consists of a tray of flanged steel plate, B. of T.W. G. No. 14, to which a bent plate of steel, B. of T. W. G., No. 12, is riveted to form the hearth. A cast-iron back, with a nozzle, stands at the back of the hearth, having two clips formed on it, which fit over the edge of the tray. A steel back plate is hinged to the tray, and, when working is kept in an upright position by a double turnbuckle, which secures it to the cast iron back. The tray is supported on four jointed tubular legs of steel. The upper joint of each leg is riveted to a M.C.I. bracket riveted to the corners of the tray. The joints are of metal protected by sliding collars of steel. When in use the lower limbs of the front legs are vertical, and those of the rear inclined outwards. Steel stays are hooked into eyes on the legs to keep them steady.

An iron frame, on which the blower is carried, is attached to the back of the tray by two steel thumbscrews secured to the frame by brass chains. These screws pass through plain loops formed at the corners of the frame at the back and screw into sockets formed in the rear leg bracket. The blower consists of a

metal case containing one large and two smaller cylinders similar to that for the field forge Mark III, p. 59. The case is attached to the frame by three bolts and a screw. A metal bracket for the support of the driving gear is riveted to one end of the frame. The driving gear is arranged so that it is impossible to turn the cylinders of the blower the wrong way.

The driving gear consists of the following parts :—

A steel gudgeon A with mitre wheel B, 19 teeth, nut and pin.

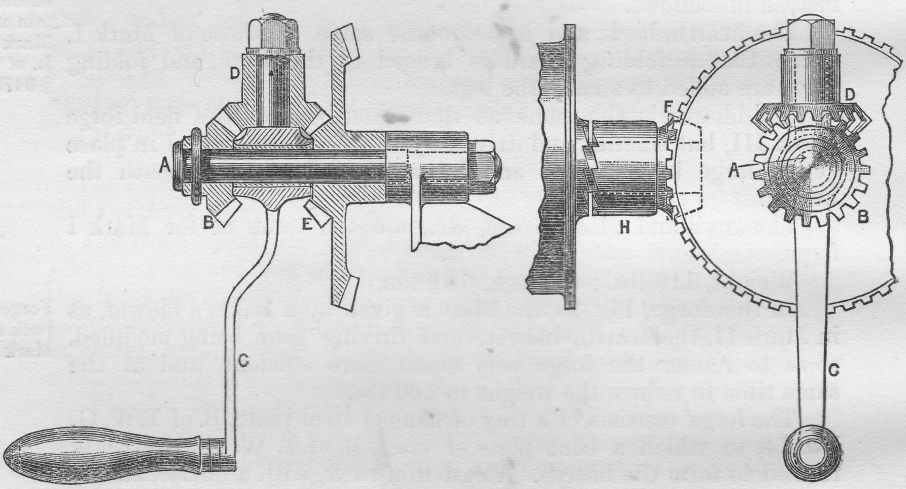
A steel lever C, with handle, metal mitre wheel D, 19 teeth, and nut.

A metal bevil wheel and pinion E formed in one casting.

A metal bevil pinion F, 17 teeth, with iron nut and pin.

A metal collar clutch H.

Fig. 26.




The gudgeon A, is supported at one end in a bearing in the bracket on the frame and is prevented from turning by a feather. On the other end is keyed the mitre wheel B. The double wheel and pinion E, fits loosely on the gudgeon next the bracket; the lever C is formed with a metal bushed ring, which fits over the gudgeon, between the wheels B and E, and can turn freely round it. The wheel D is secured by a nut on a gudgeon projecting from the ring. This wheel gears both with the fixed wheel B and the loose pinion E. The wheel E gears with the pinion F, which fits on the end of the spindle of the fan cylinder of the blower. The pinion F is formed with a sleeve, on the outside of which there is formed the thread of a screw. The collar clutch forms a nut which works on the sleeve. Ratchet teeth are formed on the face of the nut

next the casing, and also on the cover of the casing itself. Should the lever handle be turned in the wrong direction the collar will move along the sleeve towards the casing, until the teeth on the collar engage with those on the casing, and all further motion in that direction is arrested. When the handle is turned correctly the collar moves away from the casing, and towards the pinion.

A steel cover fits over the blower and part of the driving gear, and is attached to the frame by a thumbscrew.

A weatherboard of steel with clips can be fitted vertically to either the front or the right hand side of the hearth.

For transport, the cast iron back is laid in the hollow of the hearth, the tie rods of the legs are laid in the tray, the hinged back plate is folded down, the weatherboard is laid on the front of the tray, with its nib irons projecting through slots in the front flange, and is secured by the turnbuckle of the hinged back plate.

The frame carrying the blower is secured by split pins to three studs riveted to the underside of the hearth plate. The blast pipe is secured by a key to a stud on the frame. Two pairs of links are attached, by loops riveted on, to the left side of the hearth tray, for suspending the forge from the hooks of the G.S. pack saddle. It is secured by a leather strap 2″ × 72″.

Girth, web, R.M.L. 2·5″.

The girth is a 4″ hemp web, with a leather safe at each end to prevent chafing, and a chape with 1·5″ japanned roller buckle for attaching it to the metre straps.

Handspike, R.M.L. 2·5″, Mark II.

The handspike is of ash, 3′ 7½″ long. It is fitted with an iron stud at the end to suit the bayonet joint of the socket in the trail. Weight 4 lbs.

Mark I handspike had a wrought-iron shoe. Weight 6 lbs.

Holdall, small stores, R.M.L. 7-pr.; also 2·5″.

This holdall is of leather 2′ 14½″. It has a pocket and side flaps, and is fitted with a ¾″ strap with a buckle. Loops to carry the small stores are formed by a wide strip of leather sewn on.

Holdall, tool, artificers, leather, for Clarkson's artificers' box.

The holdall, which is 48″ long and 13″ wide, has two straps sewn on lengthways on it, forming a series of loops for holding the small tools It is fastened with a 1″ strap and buckle, when folded up.

Pannels, R.M.L. 2·5″.

Each pannel consists of a pad of leather and collar cloth, stuffed with horse hair. Two leather pockets are sewn on the outside, by which it is attached to the side bars. The stuffing can be rearranged when necessary, through an opening in the outer side, which is covered by a leather flap. Weight 20 lbs. 7 oz.

Pockets, 2·5″ equipment.

These consist of eight leather pockets:—

Two for drag washers and clinometer.
„ foresight.
„ tangent scale.
„ range table

The pockets are of leather, each has a leather loop sewn on the back, by which it is attached to the sight pocket strap. The cover of the tangent scale pocket is fastened by a buckle and strap, the remaining covers are fastened by metal studs One of each of these pockets is carried on the breech, and one on the chase cradle.

Rack, entrenching tool.

Leather racks are pieces of stout leather, 32½″ long × 25½″ wide, fitted on the outer side with loops, &c., to carry entrenching tools, and at the back with links for attachment to the saddle. They are "off" and "near," differing in the position of the leather fittings only, and buckle together by means of two leather straps across the saddle. A pair of racks weigh 25¼ lbs.

Rein, leading, bridoon.

Is a leather rein with T-piece of galvanised iron at each end.

Rope, check, Mark II.

The check rope is of 2½″ white rope, 7′ 2″ long, with an iron hook at each end. It is used to skid the wheels during recoil; for this purpose its centre is passed around the hook on the trail, and each end, after taking a turn round a felloe in the wheel, is secured by its hook.

Rope, drag, light.

Is a 2″ white rope 15′ 6″ long, with an iron hook at each end.

Side arms.

The sponge for the 7-pr. steel gun of 200 lbs. is the same as that for the 9-pr R.M.L., including wadhook, but shorter in the stave; its total length is 3′ 9″, and weight 2 lbs. 13 ozs. That previously sealed for the steel gun of 150 lbs. was similar, length 2′ 11″, weight 2 lbs. 5 ozs. The gun brush is the same as for 9-pr. R.M.L., but with shorter stave; total length 4′, weight 2½ lbs.

The present sponge (Mark II) for the 2·5″ is similar in every respect to the Mark I, p. 110, excepting the recess of the rammer head, which is slightly different to suit the point of the projectile.

Stick, head, R.M.L. 2·5″.

The head stick is of ash 3′ 6″ long with a galvanized iron spring clip attached to one end by a link and shackle, and a leather thong at the other end secured through a hole in the stick.

Strap, cloak and line gear.

Consists of two straps 1″ × 48″ with connecting piece.

Strap, line gear, large.

Consists of two straps 1¼″ × 54″ with connecting piece.

*Strap, lashing, overall,* 129″ × 3″, *R.M.L.* 2·5″.

Straps, lashing.

Leather, with two buckles for ammunition saddle.

This strap has two tongues, and two buckles for lashing the ammunition boxes to the cradle.

*Strap, lashing, carriage,* 54″ × 1½″, *R.M.L.* 2·5″.

Leather.

*Strap, lashing, wheels,* 82″ × 1½″, *R.M.L.* 2·5″.

Leather.

*Strap, lashing gun,* 35″ × 1½″, *R.M.L.* 2·5″

Leather, for breech or chase.

The above straps are alike in every respect, with the exception of the length. These are fitted each with a 1½″ japanned iron roller buckle.

*Strap, metre, girth,* 24″ × 1½″ *R.M.L.* 2·5″.

Leather with toggle, four to a saddle. Strap, metre, girth, R.M.L. 2·5″.

This is a plain strap double, with a wooden toggle sewn in the centre to prevent its slipping through the slots in the cradle.

Is a plain double strap of leather 1½″ × 28″ with a wooden toggle similar to the girth strap. Strap, metre, surcingle, R.M.L. 2·5″.

*Strap, sight pocket,* 41″ × 1¼″, *R.M.L.* 2·5″.

Leather, two to a set. Strap, sight, pocket.

This strap has a 1¼″ tinned roller buckle for securing the pockets for the drag washer, foresight, tangent scale, and range tables to the cradle.

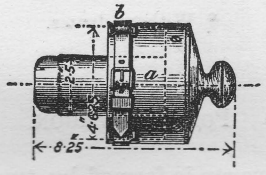
*Surcingle, web, R.M.L.* 2·5″.

One to a saddle for gun, carriage, and axletree saddle. The surcingle is of 4″ hemp web with chape and buckle at each end for attaching it to the surcingle metre straps, which are secured to the cradles. It is similar to the girth but 4″ longer. Surcingle.

The tampeon for the 7-pr. is of elm with an iron knob as handle: the portion which enters the bore is covered with collar cloth, and has strips of leather to enter the grooves of the rifling. The inner end of the tampeon has two small eyes for the attachment of a wad. Tampeons.

The tampeon for the 2·5″ gun Fig. is of elm bound round with two layers of collar cloth glued on. It is fitted with a leather cap (*a*) which passes over the muzzle of the gun, to which it is secured by an 18″ strap (*b*).

Fig. 27.




*Valise, Quartermasters' Stores, R.M.L.* 2·5″

Is cylindrical in shape and is made of tanned canvas lined with tanned duck cemented together by indiarubber cement, the ends are made of two folds of leather with canvas between, there is a slit in the centre of the body closed by lacing. Valise, Quartermasters' stores, R.M.L. 2·5″.

Length 3′ 0″, diameter 1′ 6″.

# SECTION V.—ENGINEER AND TRANSPORT CARRIAGES.

## CHAPTER I.—ENGINEER CARRIAGES AND STORES.

The following table gives the carriages, manufactured in the R.C.D., which are specially intended for the R.E.

| Description. | Weight, empty. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | Tons. |
| Pontoon wagon .. .. .. .. .. .. | 16 | 1 | 8 | 7·502 |
| Cable ,, .. .. .. .. .. .. | *21 | 1 | 5 | 6·777 |
| Office { lithograph .. .. .. .. .. | 24 | 2 | 0 | 11·962 |
| Office { photograph .. .. .. .. .. | 25 | 3 | 0 | 11·962 |
| Office { printing .. .. .. .. .. | 24 | 1 | 0 | 11·962 |
| General service wagon .. .. .. .. .. | 21 | 0 | 14 | 4·408 |
| Forge wagon .. .. .. .. .. .. | 25 | 1 | 19 | 4·615 |
| Air-line wagon .. .. .. .. .. .. | 21 | 2 | 5 | 13·990 |
| Timber wagon .. .. .. .. .. .. | 20 | 1 | 0 | 4·813 |

* Without drums.

### Pontoon Wagon.

Pontoon wagon. L. of C., § 2910. Plate XXVI.

The body of this wagon is formed by two sides, bolted in front to a bolster placed beneath them, and in rear to a cross bar placed over them. The sides in rear are supported on the springs, which rest in axle blocks upon the shoulders of the axletree, and are secured by axle staples and clip plates. In front, the bolster with a wheel plate rests upon the fore carriage, the latter being connected with the body by a main pin. The sides of the wagon have a slope of 3° when the wagon stands upon the level.

The fore carriage is formed by four futchells, a cross bar, splinter bar, bolsters, and a wheel plate connected in the usual manner, and attached by springs to the fore axle in the same manner as the body to the hind axle. Over the front of the futchells there is a shallow box fixed, and at each end of the splinter bar a plate.

For the pontoon boat to lie upon, four bolsters are fitted upon the frame of the body, two immediately above the hind axletree upon a cross bar over the sides, and two on the bolster immediately over the fore axle. The wagon standing upon the level, the upper surfaces of the bolsters lie in a horizontal plane; upon its outer end each has a metal friction plate which is formed into a stop to keep the pontoon in position. When the boat is upon the wagon, there is space for some of the baulks of the superstructure to lie underneath it between the bolsters, which are hinged to facilitate their removal.

Beneath the sides are two vertical cross frames or "chess carriers;" the hind cross bar of the wagon forms the upper part of the hind frame, while the upper frame is placed 9′ more to the front. In the hind frame there are two hinged pieces, which can be turned down to admit of the chesses being placed, and are secured when in position by turnbuckles on the cross bar.

The wagon is fitted with a drag shoe and chain on the near side and with fittings to carry an anchor on the off side; there are also fittings for carrying entrenching tools and stores.

The wheels used with the wagon are 3rd class B, Nos. 145 and 150, 4′ 8″ and 3′ 4″ respectively in diameter.

The wagon may be used as a trestle wagon, when instead of the boat, it carries the service trestle and part of the bridge superstructure.

Pontoon boat, Mark I. L. of C., § 3125.

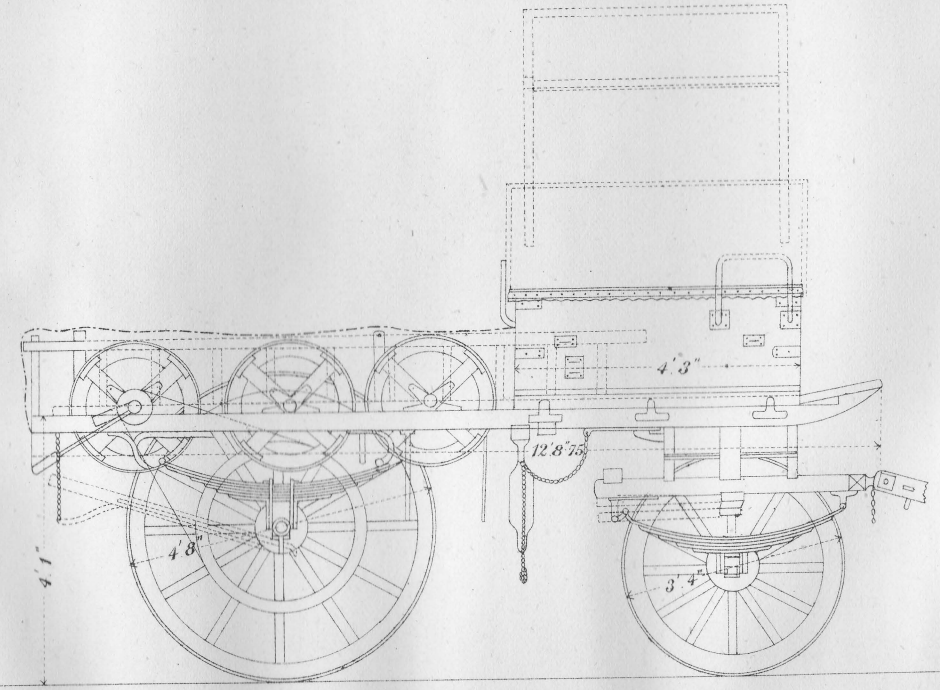
The pontoon can be used either as a pontoon in a bridge or as a boat: its outside dimensions are 21′ 1″ × 5′ 1″ × 2′ 6½″ in depth; its weight is 9 cwt. 2 qrs., and its tonnage 9·685 tons. In horizontal section it is rectangular, its sides are nearly straight and vertical, and its ends curved. The framework, which is very light, is of yellow deal and rock elm, the straight parts being made of the former, and the bent of the latter. The frame is boarded over with yellow pine, and each side of the boarding covered with canvas attached by india-rubber solution. The canvas is covered with marine glue and knotting before the pontoon is painted, and the bottom protected by four longitudinal ribs shod with iron friction plates. The pontoon has eight wood handles along each side, about half-way up, six attached by rope grummets and two by wire, the latter serving as eyes to receive lashing ropes; it has also a ring at each end for a cable, and is fitted with four rowlocks along the gunwale at each side, and at each end with one for a steering oar; it has also fitments for securing the saddle beam. The total weight of the pontoon wagon, when packed is 2 tons 1 cwt.

## Cable Wagon.

Cable wagon. Plate XXVII. L. of C., § 2909.

The body of this wagon is formed by two sides and two summers mortised into a hind earbed and a front cross bar. The connection of the body with the hind axle and fore carriage is the same as in the pontoon wagon.

# WAGON CABLE.




To face page 123.

DANGERFIELD LITH 22, BEDFORD ST COVENT GARDEN.

The fore carriage differs from that of the pontoon wagon in having shorter futchells, no box over the front ends of the latter, and a board over their hind ends.

On the sides and summers of the wagon body towards the rear there are iron socket plates for the spindles of six drums to rest in, in which the rear drums are secured by capsquares, each retained by a turnbuckle. An arrangement is fitted on either side of the wagon for winding up the wire on the hindermost reel; it consists of a wooden drum fixed upon the inside of the hind wheel of the wagon and concentric with it; from this an endless india-rubber band with the ends fastened together by two clips, leads round a small band wheel held in an iron bracket upon the side of the wagon and the rear of the hind wheel. The axis of the band wheel lies in prolongation of the spindle of the wire drum, and has upon its inner side a ratchet clutch, corresponding to a similar clutch on the spindle of the drum. The band wheel is moveable on its axis, and by means of a lever handle its clutch can be thrown in or out of gear with the clutch of the wire drum. When the clutches are in gear and the wagon moves forward the wire is wound up. Two small iron rollers are fixed on the earbed of the wagon immediately in rear of the wire drum for the wire to run over. Two iron frames are fitted over the summers between the drums, and a drop board is hinged at their ends, which is secured when in position by hasps and turnbuckles to stays attached to the rear frame. The poles and a ladder are carried in the frames to support the drum barrow when it is carried under the hind part of the wagon, there are two chains with hooks, attached to the futchells underneath in rear, which hook into eyes upon the axle of the barrow, while the handles of the latter rest in iron loops on the hind axletree of the wagon.

On the front part of the frame of the wagon three boxes are carried, two large, fitted with guard irons, and one small, between them at the front. The lids of the former open outwards, and when open, a temporary office can be formed between them with a cover and frame to support it, carried for the purpose. The near box has a door in its side to permit of stores being withdrawn without mounting upon the wagon.

A circular hole 3″ in diameter is made in the rear end of the near box, and is glazed, to allow a galvanometer which is carried inside to be read. Terminals are fixed inside the box, and from one of them a wire is carried through the bottom of the box, along the summers, and under the bearings of the drums: the terminal on the drum is also connected with the spindle by means of an iron plate. Thus the wire on any or all of the drums can be connected with the terminal in the box. From the other terminal wires are also carried to the front scroll irons of the hind springs, to the main pin, and from that to the hind scroll irons of the front springs. A wire is also soldered to the metal nave of each wheel, and is let into and carried down the back of two opposite spokes, through the felloes and tire, and is riveted to the latter; by this arrangement the wheels can be used as "earths."

The wagon is fitted with a drag shoe, and has strapping for carrying tools, small stores, and stick for raising the wire; a canvas cover is issued with it for covering the drums. The wheels are 3rd class B, Nos. 146 and 150, 4′ 8″ and 3′ 4″ in diameter respectively.

Drums for wire.

The drums upon which the wire is coiled consist each of two circular frames, 2′ 0″ in diameter, of oak shod with iron, placed 11″ apart and connected by ribs of deal, which latter are so fixed as to form a hollow cylinder 9″ in diameter concentric with the oak frames The wire is wound round the cylinder and the ends or frames keep it in its place. An iron spindle is passed through the drum, upon which the latter is supported, either in the wire wagon or drum barrow. One end of the spindle is square to receive either the clutch of the winding-up arrangement of a wagon, or a cranked handle for the same purpose. A terminal is fixed upon one end of the drum; the weight of the latter is 1 qr. 3 lbs., and of the wire it carries 133 lbs.

Poles.

The poles are either of fir or bamboo. The fir poles are 15′ long in two lengths, 13′ and 8′. They are described in Appendix H, page 499.

The bamboo poles are of two lengths 13′ to 13′ 6″ and 6′ respectively.

The upper end of each is plugged with a piece of pine, and bound with copper wire. The plug is drilled to take the insulator.

Guys, telegraph pole.

The guys are of white line, each is 15⅔′ long, with a hook at one end and knot at the other, and is fitted with a beech runner.

Telegraph ladder.

The telegraph ladder is made of ash with oak rounds; it is 17′ long, in two lengths, which can be used separately or together. Weight 1 qr. 17 lbs.

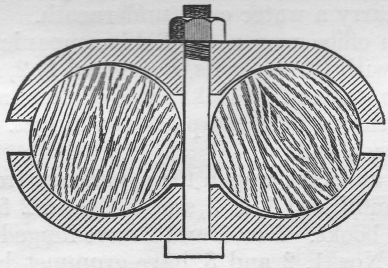
Stick for raising wire.

The crook stick for raising the telegraph wire is a slight ash stave, fitted with a double crook and roller between; its total length is 7′.

Clips, pole, intermediate. § 3706.

These clips or bands are made of wrought-iron ¼″ thick, with ⅜″ nut and bolt. Their form is shown in Fig 28.

Fig. 28.



Pickets, guy.

These pickets are of iron, length 12″, dimensions of head $2\frac{3}{4}$″ × $\frac{3}{8}$″; weight 1 lb.

Staples, supporting, wire.

The staple is of iron galvanized. It consists of a spike 6″ long, with a ramshorn projection at one side of the head.

## Office Wagon. Mark II.

Office wagon. Mark II. Pl. XXVIII. L. of C., § 2903.

The frame of this wagon is cranked, formed in the usual manner, and boarded over. The sides, end, and roof, which is arched, are fixtures; and are covered inside and outside with canvas. A well is formed in the floor in front of the axletree to enable a man inside to stand upright: in the roof on the near side are two openings for lamps.

The back of the wagon is closed by folding doors, and a sliding step is fixed underneath.

The interior is fitted up either as a printing office, or for lithographic or photographic purposes. In the latter case a second well is made in rear of the axletree, the lamps are put in the off side of the roof, and the interior is specially fitted.

The body of the wagon is attached to the hind axle and to the fore carriage, as in the pontoon wagon, except that the hind axle lies over instead of under the springs.

The fore carriage is the same as that of the cable wagon, but not fitted with a board over the hind extremities of the futchells.

On the fore part of the body a large box is carried, serving as a seat.

The wagon is fitted with a drag shoe, and has fittings to carry a spare hind wheel between the driving box and the body; there are also fittings for carrying small stores.

The wheels used are the same as for the pontoon wagon.

## General Service Wagon.

General service wagon. Pl, XXVIII. L. of C., § 2902. § 3538.

The body of this wagon is similar to the R.A. ammunition and store wagon, Mark II, but has sides 2′ in height, and is fitted with springs.

Floating raves are issued with it, bale hoops and canvas cover, and it is fitted to carry a water cask underneath.

It is used as an office wagon for field companies or field park, and then is fitted with three chests, numbered 1, 2, and 3, with lid opening at the side, secured by locks; two of them are also secured by screws passing through the straps of the hinges. They have a folding handle at each end.

When used as an office wagon for a pontoon troop, it is fitted with four chests, numbered 1, 2, 3, and 4; 1 and 2 for stationery, 3 for arms, and 4 for books. Nos. 1 and 2 have hinged lids, the others open at the side. Nos. 1, 2, and 3, have grummet handles, secured by cleats.

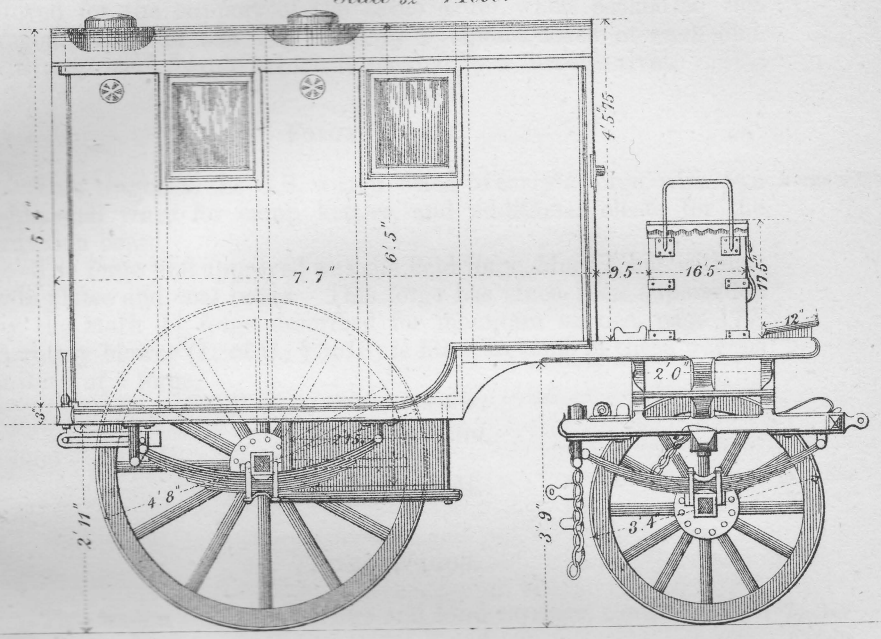
The capacity of the wagon is $68\frac{2}{3}$ cubic feet.

The wheels used with the wagon are the same as for the pontoon wagon.

# WAGON OFFICE.

## MARK II.

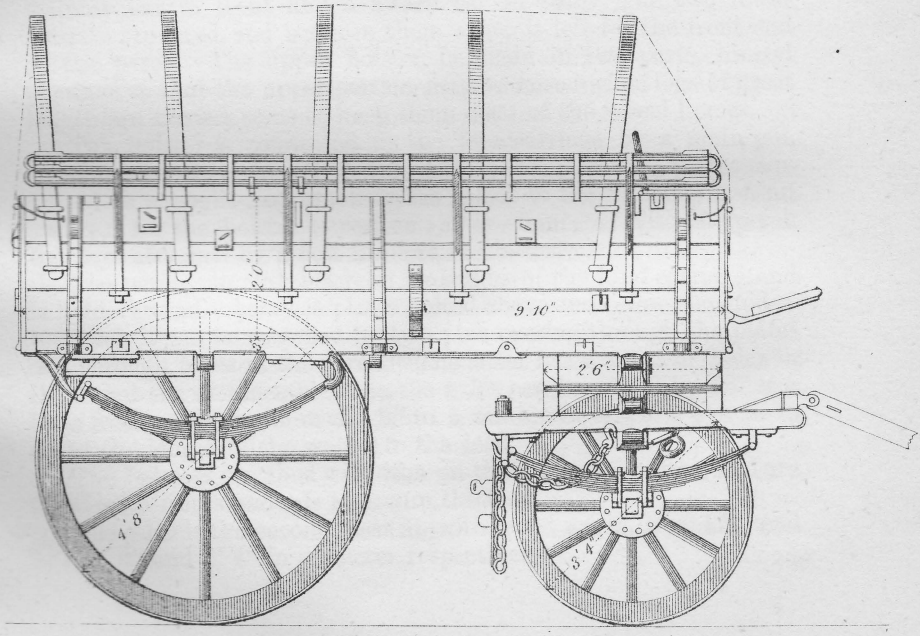
*Scale $\frac{1}{32}$" = 1 Foot.*




# WAGON, GENERAL SERVICE. R.E.

## MARK I.

*Scale $\frac{1}{32}$" = 1 Foot.*




12449.

DANGERFIELD, LITH. 22. BEDFORD ST. COVENT GARDEN.

A spindle drum travelling for G.S. wagon R.E. has been approved for the support of the cable drum, when packed in the wagon. It is of ash 14½″ long, by 1″ square, fitted at each end with a ¾″ steel ferrule, which is secured by a through rivet.

## Forge Wagon.

Forge wagon.

This wagon is the G.S. wagon fitted to carry a forge, with two additional rings for camp kettles, and additional cleats for the partition board.

The forge first approved was the field forge, Mark I, but without side plates and coal boxes. This forge has since been superseded by the Mark II forge described for mountain service, page 177. A rotary blower (L. of C., § 3518) is fitted in some of these wagons instead of a forge.

## Air Line Wagon.

Air, line wagon.

See Appendix H.

## Timber Wagon.

Timber wagon. L. of C., § 3415.

This wagon consists of a fore and hind carriage, connected by a sliding perch.

The hind carriage is formed of an axletree held in a wood bed, above which a bolster in three pieces is secured. Staunchions or guides to receive the perch project towards the front.

The fore carriage is formed of an axletree in wood bed, with three bolsters over the latter, and two futchells, connected by a splinter bar in front and a sweep bar in rear. The two lower bolsters are fixed, and between them space is left for the front end of the perch. The upper bolster is made in two parts, hinged together, so that the upper portion may be raised when logs of great length are carried, so as to keep them clear of the wheel horses.

This bolster is connected to the fore carriage by a main pin, which also secures the front end of the perch; locking plates supported on wrought-iron brackets, are bolted to the futchells in front and rear for the bolster to rest on; it is connected with the perch by stays attached by a bolt through the latter.

The perch can slide between the guides of the hind carriage, and is held vertically between plates bolted above and below the guides to which it can be attached by two pins passing through the plates and through holes in the perch. The latter has a series of holes in it, so that the distance between the axles can be varied by 18″ at a time from a maximum of 16′ 9″ to a minimum of 10′ 9″, so as to adapt the length of the wagon to the load.

The bolsters are shod with iron on their upper surfaces, and are fitted with iron standards to secure the load.

The wheels are second class B, with wood naves, Nos. 130, and 131, 4′ 8″ and 3′ 4″ in diameter respectively.

## Pontoon Equipment.

The bridge superstructure for the pontoon boats, carried on the pontoon wagon, consists of the following parts:—

Baulks, wood, Mark II.
„ „ shore end, Mark I.
Baulks, wood, shore end, Mark II.
„ „ cut.
Beams, saddle.
Chesses „
Lines, breast or buoy.
Ribands.
Saddles, baulk.
„ „ cut.
Sticks, rack, with lashing.
Transoms, wood, shore, Mark II.
„ „ „ Mark III.

The saddle beam is hollow, rectangular in section, the top of beech, the sides and bottom of Baltic fir; 10′ 1″ in greatest length, 8″ deep, 4″ wide. It rests longitudinally in the boat on the thwarts, and is secured at each end by two pins, which pass through holes in straps hinged to the end of the beam, and through holes in the thwart, and are keyed beneath.

The saddle is a frame formed of two side rails of fir, 10′ 7″ long, 2¼″ deep, 2″ wide, connected by cleats of rock-elm. It rests over the saddle beam, and the cleats are arranged in pairs at equal distances to receive the ends of the baulks. There are five sets of curved cleats, which receive the ends of as many baulks, to form a bridge for general purposes; there are also four sets of cleats, shorter, and with square ends, which divide the distances between the others, and are used to receive four additional baulks, which are necessary for the passage of siege guns over the bridge. There are wood handles at each end.

The baulks are of Kawrie pine, 15′ 9″ long, 3¼″ broad, 6″ deep. They extend from boat to boat, and their ends fit between the cleats on the saddle, and are halved vertically, so that two successive baulks lie in the same line. The halved ends are strengthened by iron plates at top and bottom, the bottom plates having claws, which prevent the baulk slipping off the saddle.

§ 3673. The shore end baulks Mark I, are 3′ 9″ long, three inside and two outside to a set. They differ from the long baulks in being made with a taper.

§ 5041. The shore end baulks, Mark II, are inside 3′ 7″, outside 3′ 6¼″, in length, three inside and two outside to a set. These baulks supersede Mark I. The upper surface of the baulk, on which the chesses rest is cut with a series of notches so as to set one edge of each of the chesses up ½″ to give a foothold.

A top piece supported on oak blocks is riveted over each of the outside baulks, the intervals between the top piece and the notched upper surface of the baulk forming slots for the ends of the chesses.

The cut baulks are 9′ 10″ long, four to a set. § 5041.

They are rounded at one end and tapered at the other; the rounded end is fitted on its under side with an iron plate, with one claw. Four holes are drilled through the baulk, two near each end.

The chesses are planks of Kawrie pine, 10′ long, 12″ wide, 1½″ thick. They lie side by side across the baulks, and form the roadway: they are made narrower at the ends, to allow of the rack lashing being passed between two adjacent chesses, and also to admit the buttons of the ribands.

The ribands are of pine, of the same dimensions as the baulks, and halved at the ends in the same way. They lie over the chesses on each side of the roadway, and have 14 wood buttons, which fit into the spaces between the ends of the chesses.

The rack stick is a short, pointed stick, with a piece of 2″ rope 8′ long, spliced through a hole in one end. It is used to lash down the chesses.

The shore transom consists of two pieces of plank at right angles, the vertical plank is cut to admit the shore ends of the baulks, and is strengthened by cleats.

Shore transoms, Mark III, supersede Mark II, from which they differ in having each pair of cleats arranged to take the ends of two baulks. § 5041.

The saddle baulk, cut, consists of a plank of Kawrie pine, 10′ 6″ long, with the ends rounded off to form handles. It is fitted with four pairs of iron eyes to receive metal pins furnished at one end with a jointed attachment and at the other with an eye to receive a lanyard.

The following miscellaneous stores also belong to the equipment:—

This is a tin scoop with tin handle. Balers, tin,

This consists of two hollow cones of sheet iron base to base with a swivelling eye at each end. Buoy, for anchor.

The stave of the boat hook is fitted with two curved hooks at one end; it is graduated in feet alternately white and lead colour. Boat hook, 11′ 7½″.

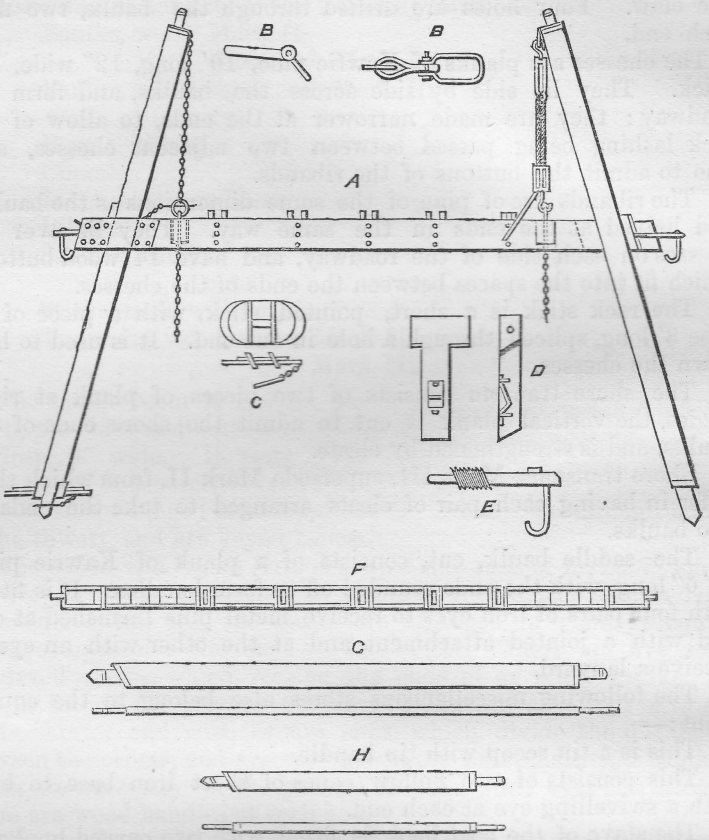
The stave is fitted with a single hook, with a point. Boat hook, 6 feet.

The oar is of ash. It is 11′ long. There is a slot cut in the centre of the blade. Oar.

The trestle (Fig. 29) is of the Birago pattern, modified, and consists of a transom and two legs. The transoms A and F are 18′ 6½″ long, 11½″ deep, and 8″ wide. It is made of two 2″ deals separated by wood blocks placed at about 2′ 3″ central intervals and fastened with ½″ iron bolts and rivets. It is fitted with cleats corresponding to those on the pontoon saddles. Trestles, bridging, Aldershot pattern.

Two pairs of legs are provided with each transom, one long 16′ 6½″ and one short 9′ 7″ in length. They have a scantling of 8½″ × 3½″, and are graduated at 3″ intervals. They are provided with shoes, C, 2′ 6″ × 1′ 2″, made in two thicknesses of 2″ each, and strapped with 2½″ iron. They are secured, each by an iron

Fig. 29.



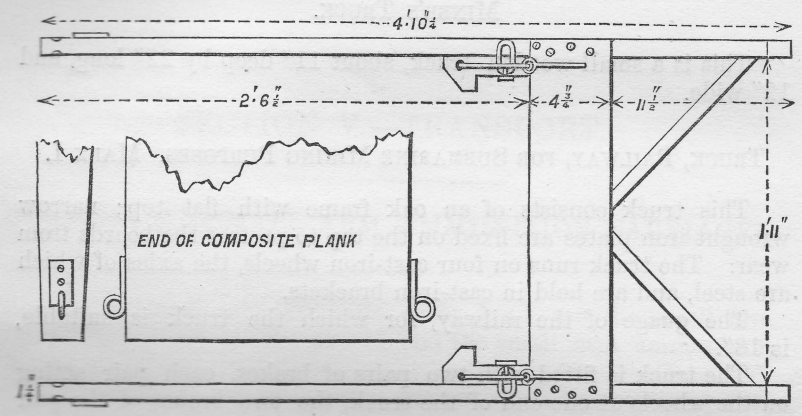

pin passed through the foot of the leg. The legs pass through slots in the ends of the transoms, and are secured, when in position, each by an iron clamping screw, E, $1\frac{7}{8}$″ diameter, which works in a strong block at the end of the transom. The point of the screw is received in a clamping block, D, which lies flat against the leg, and is recessed to offer a fair surface to the pressure of the screws. Two chains of $\frac{3}{4}$″ iron, with shackles, B, and two tackles, each consisting of one double and one single 5″ iron block, with two fathoms of 2″ tarred rope are provided
§ 3519. with each trestle.

## Equipment for Berthon's Collapsible Boats.

*Saddle.*—Each saddle is a small two-legged trestle (Fig. 30), the feet of which are prolonged above the transoms, to form staunchions

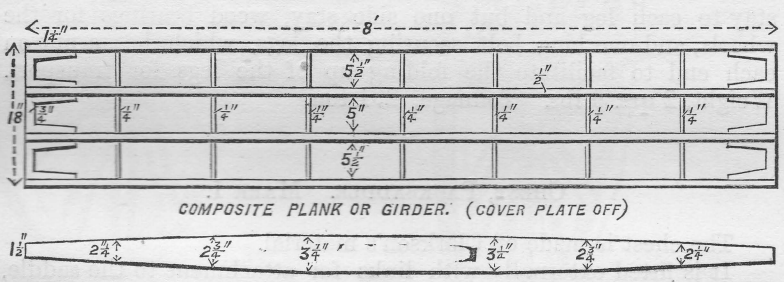
for a rope rail. The saddle is held in its place by guys of copper wire, two are 40″ long, and are fitted with stirrups, and two 33½″ long with thongs.

Fig. 30.




*Plank composite.*—The plank is made with top and bottom of Kawrie pine, each 8″ × 18″ × ⅜″, fixed down on fir longitudinals,

Fig. 31.




each ½″ thick, and varying in depth from 3″ at centre to 1½″ at each end. The ends of the longitudinals are connected by V-shaped blocking pieces of English elm, and the longitudinals are also connected by pine distance pieces.

*Landing transom.*—This consists of a short elm board with an iron loop at each end. It is fitted with two staples with hasps,

and two pins attached by short cords. Pickets 5′ long, 8″ diameter, are driven through the loops to retain the transom in its place.

*Anchor.*—Is of iron galvanized. Weight 14 lbs.
*Cable.*—Is of white Italian hemp, 1½″, 20 fathoms in length.

### Miner's Truck.

Miner's truck.

This is a small wooden truck, about 11″ deep by 22″ long, and 12″ wide.

### Truck, Railway, for Submarine Mining Purposes. Mark I.

Truck for submarine mining. Mark I. L. of C., § 3521.

This truck consists of an oak frame with flat top; narrow wrought iron plates are fixed on the top to protect the boards from wear: The truck runs on four cast-iron wheels, the axles of which are steel, and are held in cast-iron brackets.

The guage of the railway, for which the truck is suitable, is 18″.

The truck is fitted with two pairs of brakes, each pair acting on the wheels at one end of the truck, the two brakes of the pair being connected by a cross shaft; each pair is worked by a long lever along the side, the levers being on opposite sides of the truck. Weight, 6 cwts. 3 qrs. 14 lbs. Tonnage, 1·555 tons.

### Entrenching Barrow. Mark II.

Entrenching barrow. Mark II. L. of C., § 3295.

This is a wooden barrow with iron wheel, the legs being made to fold along the side. It differs from Mark I in having a centre stay to each leg and but one side stay, wood bearings for the wheels, and one long bolt securing the legs, which has a nut on each end to facilitate the folding up of the legs for transport. Weight, 2 qrs. 9 lbs. Tonnage, ·291 ton.

### Chest, Packsaddle. Mark I.

Chest pack-saddle, Mark I. L. of C., § 3209.

The chest is made of Clarkson's material.

It is fitted externally with links for attachment to the saddle, and a wrought iron buckle for the web girth, and internally with pockets, &c., for carrying tools. Weight 21½ lbs.

The girth is of 3½″ web, with leather ends. Length, 7′. Weight, 1 lb. 5 ozs.

### Tool Racks.

Tool racks, L. of C., § 3212.

These racks are similar to those for mountain service; each is 3′ 1″ long by 2′ 4″ wide. Weight of pair, 26 lbs. 13 ozs.

### Packsaddle Demolition Equipment.

Two leather wallets are approved for this equipment. They are off and near. The near wallet is divided by a cross partition, and is fitted with a wood box to hold a friction electric machine. Packsaddle demolition equipment. § 3648.

On the top of each a valise is strapped, which contains a reel to hold telegraph wire.

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## SECTION V.—TRANSPORT.

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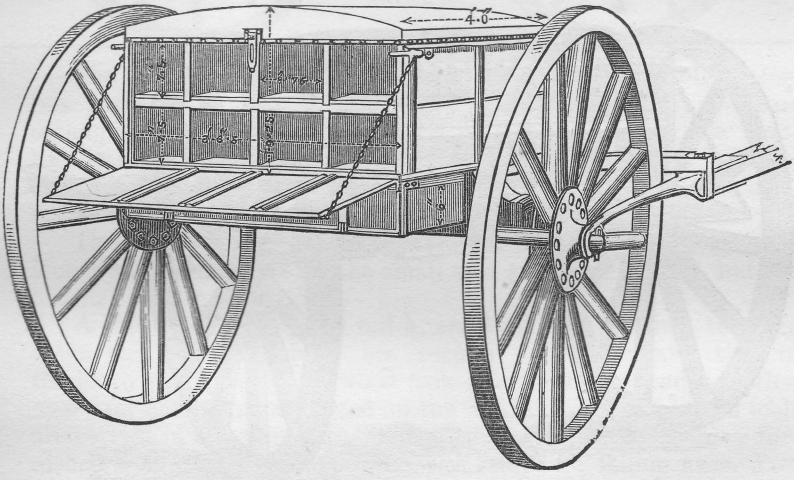
## CHAPTER II.—SMALL ARM AMMUNITION CARRIAGES.

The carriages included under this head are the small arm ammunition carts, Mark I and II, and the small arm ammunition wagon.

The weight of the small arm ammunition cart empty is 8½ cwt., and its tonnage 2·468 tons. § 2027. Small arm ammunition cart, Mark I.

Fig. 32.

Scale about $\frac{1}{24}$ full size.




The frame of the cart is formed by two sides, and a summer of tee iron, bolted in rear to a cross piece of tee iron, and in front to a splinter bar of plate iron, trough shaped. The frame is boarded over and fitted with sides, head and tail board. The tail board and sides are hinged to the bottom, the latter not extending to the splinter bar, but leaving a space for a platform board in front. The head board is connected by hooks and eyes. An arched canvas-

covered roof is attached by screws to the sides and head board, and the interior of the box, so formed, is divided longitudinally into eight compartments, each intended to contain two small arm ammunition boxes. The tail board, when up, keeps the boxes in position, and when down is supported by chains, forming a convenient shelf on which to draw out the boxes.

The sides and summers of the frame are housed in and bolted to the axletree bed, which is of ash, and in which the axletree is secured in the usual manner.

Under the hinder part of the cart a locker is formed.

The cart when packed for infantry contains 16 boxes of Martini-Henry ammunition, each holding 600 rounds; weight of load, 11 cwts. 2 qrs. 12 lbs.

For lancer regiments the cart contains 5 boxes of Snider carbine ammunition, each 560 rounds, and 8 large boxes for Adams' revolvers, each holding 2,136 rounds; weight of load, 10 cwts. 2 qrs. 3 lbs.

For dragoons and hussars, the cart takes 16 boxes Snider carbine ammunition, and 5 small boxes for Adams' revolver, each holding 240 rounds; weight of load, 10 cwts. 2 qrs. 10 lbs.

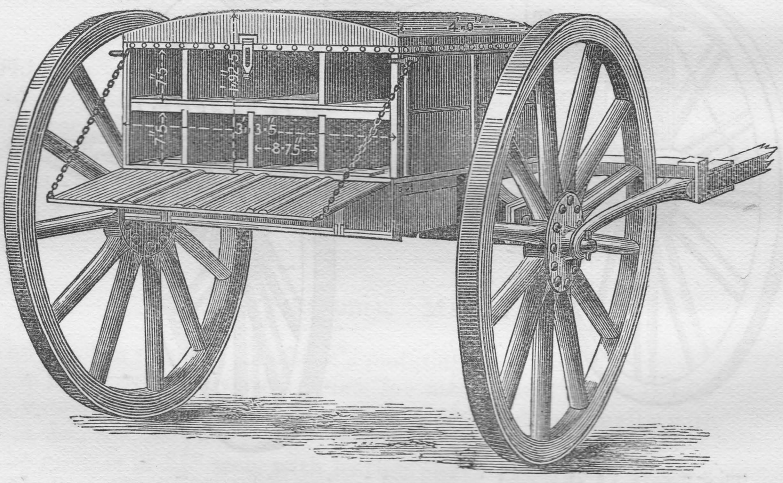
The splinter bar is fitted for double draught in the same manner as that of a field limber.

The wheels used are second class B, No. 122, 5′ diameter, and $2\frac{1}{2}$″ tire.

**Small arm ammunition cart, Mark II. § 4976.**

This cart differs from Mark I in having the centre partition

Fig. 32*a*.




of the upper row removed, thus being adapted to carry a few entrenching tools and 12 boxes of M.H. ammunition instead of 16 boxes of ammunition.

If the tools are not required; four additional boxes can be placed in the large compartment.

If required, 5 small boxes of Enfield pistol ammunition can be placed in each small compartment, 18 in the large one, and 10 in the locker beneath the body, giving a total of 13,920 rounds.

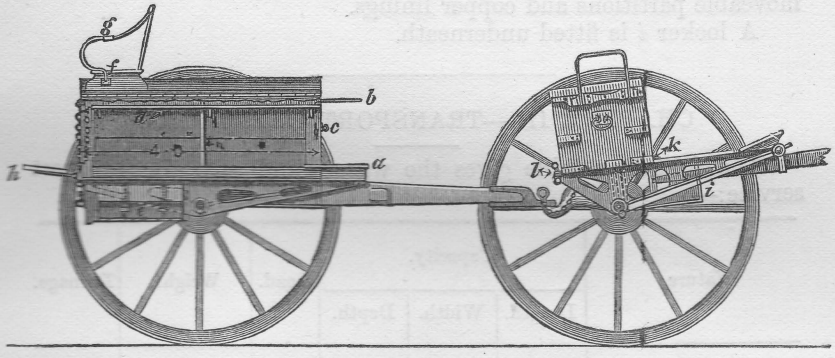
The small compartments will each hold 10 small boxes for Adams' pistol ammunition, the large one 20, and the locker 10, giving a total of 21,600 rounds.

Pistol ammunition is also packed in large boxes, 16 of which can be placed in the cart. In this case the total No. of rounds carried would be 34,176 of Adams' cartridges, or 20,160 Enfield.

## Small Arm Ammunition Wagon.

This wagon is intended for service with the Cavalry Reserves. It is constructed to carry 10,080 rounds of M.H. carbine cartridges in 16 boxes, and a proportion of entrenching tools and small stores. Small arm ammunition wagon. § 4981.

Fig. 33.




The frame-work of the wagon body consists of a hollow steel box perch, and two flanged steel futchells, connected by two bars of angle steel at the front, and by one at the rear. The axletree is a weldless steel tube with third-class arms, B pattern. It is fixed to bearings in the futchells, and connected by two steel stays to the perch.

The frame-work is boarded over and fitted with a box and a locker similar to those for the small arm ammunition cart, but the box has additional fittings.

A sheet iron pan *a*, and rail *b*, are fixed at the front to carry picks and shovels, which are secured by a lanyard tied to the loops and cleats *c*. A wood rack *d* for billhooks, and a leather case *e* for detonators are fitted on the off side. The small arm tools are carried in a leather case on the near side, which is also furnished with four leather pockets, with straps for felling axes. Two crow bars can be carried strapped along the roof. A seat *f*, with back board and guard irons is fixed across the rear of the roof, and is fitted with a broad breast strap *g*. A foot board *h* is hinged to the tail board.

If necessary, 10 boxes of Adams' or 5 of Enfield pistol ammunition can be carried in each compartment of the body.

The wheels are third-class B, 4′ 8″ diameter, 2½″ tire.

### The Limber.

The framework of the limber consists of a limber hook, three steel futchells, and axletree, interchangeable with that of the wagon body, a hollow steel splinter bar, and two steel stays. The axletree passes through the futchells and is connected to the splinter bar by the stays. The frame is fitted with a platform and footboard, and with eight steel cup springs, upon which the limber box rests. The box is secured in front by loops and staples *k*, and in rear by screws and nuts *l*.

The limber is fitted with a pair of shafts and a swingletree for single draught, and with a sliding outrigger, a draught chain, which is attached to the drag washer, and an additional swingletree for double draught. The outrigger slides in the splinter bar, and is secured, when not in use, by a pin.

The box is of wood fitted with guard irons, and furnished with moveable partitions and copper linings.

A locker *i* is fitted underneath.

## CHAPTER III.—TRANSPORT CARRIAGES.

The following table gives the wagons and carts for transport service:—

| Nature. | Capacity. | | | Load. | Weight. | | | Tonnage. |
|---|---|---|---|---|---|---|---|---|
| | Length. | Width. | Depth. | | | | | |
| Wagons— | ft. in. | ft. in. | ft. in. | cwts. | cwts. | qrs. | lbs. | tons. |
| General service lock, under Mark IV .. | 9 8 | 3 8 | 1 8 | 30 | 18 | 3 | 26 | 4·169 |
| Transport .. .. | 10 10¾ | 3 6½ | 3 2 | — | 14 | 3 | 0 | 4·678 |
| Forge .. .. | 9 8 | 3 8 | 1 8 | 30¼ | 23 | 3 | 8 | 4·516 |
| Bread and meat, cranked body .. | 10 4 | 3 11 | 2 9½ | 40 | 29 | 3 | 27 | 8·604 |
| Bread and meat, converted from heavy spring .. .. | 10 1 | 4 3 | 2 0 | 40 | 28 | 3 | 6 | 8·286 |
| Bakery .. .. | 10 4 | 3 11 | 2 9½ | 40 | 27 | 0 | 0 | 8·604 |
| Carts— | | | | | | | | |
| Forage* .. .. | — | — | — | 20½ | 8 | 0 | 14 | 2·712 |
| Forge,* complete .. | — | — | — | 15½ | 13 | 0 | 15 | 3·187 |
| Maltese, Mark I .. | — | — | — | 15¼ | 5 | 0 | 18 | 1·725 |
| Maltese, Mark II .. | — | — | — | 15½ | 5 | 2 | 9 | 1·750 |
| Maltese, Mark III .. | — | — | — | 16 | 6 | 0 | 13 | 1·6 |
| Maltese, Mark III, special .. .. | — | — | — | 16½ | 6 | 2 | 2 | 1·6 |
| Maltese, Mark IV .. | — | — | — | — | 6 | 2 | 0 | 2·307 |
| Tip, G.S. .. .. | 5 6¾ | 3 4½ | 1 9 | 15 | 9 | 1 | 9 | 2·144 |
| Water, Mark I .. | — | — | — | 17 | 7 | 0 | 7 | 5·325 |
| Water, Mark II .. | — | — | — | 17¼ | 7 | 1 | 25 | 5·325 |
| Water, Mark III .. | — | — | — | 17¼ | 7 | 1 | 12 | 4·746 |
| Water, Mark IV .. | — | — | — | 16¾ | 7 | 0 | 14 | 4·026 |

* With grease box.

Besides the above, some wagons of obsolete patterns may still be met with in the service, such as the Flanders, equirotal, heavy spring, and G.S. wagon, Mark III.

### Wagon, General Service, Lock Under, Mark IV.

Plate XXIX. L. of C., § 2805. § 4741.

This wagon is generally similar in design to the R.A. ammunition and store wagon, Mark II, but is lighter in construction. It is fitted with floating raves, a raised driving seat with guard irons, and a wide footboard. It has been approved, §4623, to remove the fittings for country harness approved in §3682. This does not include the clip loops on the points of the shafts.*

The wheels used are either Nos. 147 and 151 with iron naves, or 163, 164, with wood naves. They are B pattern, third class, fore wheel 3′ 4″, hind 4′ 8″ in diameter.

### Forge Wagon.

This is the G.S. wagon, fitted to carry the field forge Mark II and artificers' tools. The bottom of the wagon is covered with sheet iron to a distance of 2′ 1½″ from the tail board, and friction plates are provided for the forge to slide on. The partition is placed further to the rear, the near end of the splinter bar is fitted with blocks to receive a portable vice, and a nail anvil is added to the near end of the hind carbed.

### Transport Wagon.

For description of this wagon, see Appendix H.

### General Service Wagon, Spring, Heavy. Mark I.

G. S. heavy spring wagon. Mark I.

The frame of the bottom of this wagon is formed of tee iron; the parts, namely, two sides, two summers, and two end pieces, are riveted together, the extremities of the summers being set down under the end pieces, so that the upper surfaces of the whole are flush. The bottom boards are of yellow deal, and riveted across the frame, the remainder of the boarding is also of the same. The standards of the sides are of iron and hinged to the bottom, and the head and tail boards are removeable.

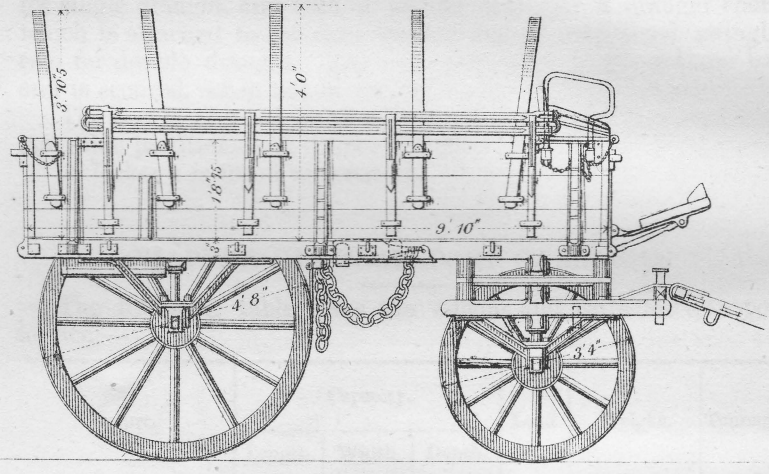
The springs are semi-elliptical, the hind springs are attached to scroll irons on the frame, and connected with the hind axle by axle staples and clip plates, a small block of wood being placed between each spring and the butterfly flaps of the axle. A check spring is attached to a bar between the summers over the hind axle, in the same manner as the side springs to the axle. Under the front of the frame, the upper wheel plate is secured by stays of plate iron.

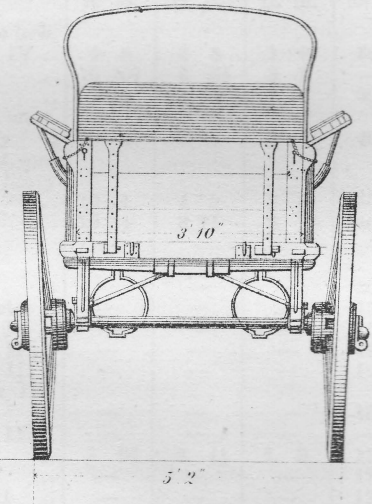
The frame of the fore carriage is a solid forging, with four arms, placed diagonally with the body; the ends of the hind arms form points of attachment for the side springs, while the ends of

* The fore carriage of this wagon is to be altered to allow a vertical movement of the pole. The shafts are dispensed with, and a new splinter bar is fitted, provided with loops to take two swingletrees for attachment of traces.

# WAGON, LOCK UNDER, GENERAL SERVICE.

## MARK IV.






DANGERFIELD LITH. 22 BEDFORD ST. COVENT GARDEN.

the fore arms are bent round and have the splinter bar bolted to them; these arms have scroll irons forged upon them for the attachment of the fore ends of the side springs. In the centre where the arms meet there is a hole to receive the main pin, which connects the fore and hind carriage. The under wheel plate is bolted to four lugs forged upon the arms. The splinter bar is of plate iron, trough shaped, and is fitted with frame shafts for single or double draught, and with links for trace hooks, the wagon is also fitted for pole draught. The side and check springs are attached to the fore carriage, and the former connected to the axle, as in the hind carriage.

A locker is formed in the fore part of the wagon body, and a smaller one under the hinder part of the body between the summers.

The wagon has floating raves, bale hoops, canvas cover, and drag shoe; it is fitted for carrying a spare fore wheel, entrenching tools, and small stores.

Many of these wagons have been converted into bread and meat wagons.

The wheels are Nos. 123 and 124 B pattern, second class, fore wheels 3′ 6″, and hind 5′ in diameter.

## Bread and Meat Wagon (Cranked Body). Mark I.

Bread and meat wagon. Mark I. § 4740.

The hind carriage or body of this wagon is cranked in form, the frame is of angle and tee iron, secured at the corners by angle plates. The standards of the sides are of iron, and are bolted to the bottom, the side boards being riveted to them. Along the top of each side a narrow rave is riveted, upon which the top of the wagon rests, and to which it is bolted; these raves are strengthened by iron stays to the side, the upper ends of which are formed into hooks. The top of the wagon consists of an arched canvas-covered roof of deal, to which are hinged two side pieces, having in them lattice ventilators, these pieces, as already mentioned, rest upon and are bolted to the raves. The rear of the wagon is closed by two boards, one turning down in usual manner of a tail board, the other hinged to the roof and turning upwards. The upper part of the front of the wagon is closed by a similar board, the lower part being fixed, and a locker, fitted as driving seat, formed in front.

The interior of the body is lined with zinc, and fitted with movable wooden trays.

The connection of the springs and of the hind axle is the same as in the straight-bodied wagon, except that the axle lies above instead of beneath the side springs. Under the fore part of the body bolsters and a wheel plate are fixed for its bearings upon the fore carriage.

The fore carriage is formed of four futchells of tee iron, riveted in rear to a cross bar of the same, and in front to a trough-shaped splinter bar. The futchells are housed in and bolted to oak bolsters, one above and one below them, to the latter the

check spring is attached, and to the former as well as to wheel bolsters, the wheel plate is fixed. Upon the outer futchells there are scroll irons for the attachment of the side springs. The splinter bar is fitted for draught as in the straight-bodied wagon.

The wagon is fitted with a drag shoe and chain, and strapping for carrying stores, &c.

The wheels are the same as for the heavy spring wagon.

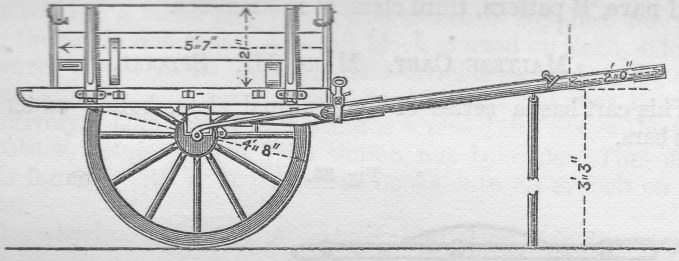
## Bakery Wagon. Mark I.

Bakery wagon. Mark I.

The wagon is similar in the construction of the body to that just described, but the roof instead of being hinged to its side pieces is fixed on sliding standards, so that it can be raised when required, canvas flaps being attached to cover the opening made, when it is so raised. Instead of lattice ventilators, in each side piece there are two glass windows protected by wire. The interior of the body is not lined with zinc, nor fitted with movable trays.

The fore carriage, &c., is the same as in the heavy spring wagon.

Fig. 34.




## Tip Cart, G.S.

Tip cart, G.S. § 2987.

This is a wooden cart, the frame of the body formed of two sides, two summers, and front and rear earbed, boarded over and fitted with movable sides, head and tail boards. The under carriage consists of four futchells, splinter bar, and axletree bed with axle. The body is attached to the outer futchells of the under carriage by a bolt and to the splinter bar by another, the latter having a handle at one end for tipping. The shafts can be arranged for single or double draught.

A small locker is formed between the summers in rear.

A canvas cover with lashing rope is issued with the cart.

The wheels are No. 147 with metal nave or No. 163 with wood nave, 3rd class B, 4′ 8″ diameter.

## Maltese Cart. Mark II.

Maltese cart. Mark II. L. of C., § 1567.

The Maltese cart consists of two side pieces, which form the shafts, bolted across an axletree bed, and connected also by a hind earbed, splinter bar, and six slats. The axletree bed is of elm, and the remaining parts of the frame of ash. Chains with a ring at the end of each are led from the axletree bed to the splinter bar for the trace hooks of the shaft horse. Upon the near side a small outrigger is fixed to the splinter bar to take a swingletree for double draught, and upon the points of the shafts there are eye plates to receive the trace hooks of a leading horse or drag ropes. The cart is also fitted with staples underneath the shafts to take slats for man draught. Props are attached to the hind part of the cart as well as to the shafts.

A canvas cover and lashing rope are issued with the cart, and a web girth attached to the shafts.

The wheels are No. 43, A pattern, 3rd class, 5′ in diameter.

Mark I Maltese cart was mounted upon 4′ 2″ wheels, and the cross bars in it were not all of the same length.

## Maltese Cart. Mark III.

Maltese cart. Mark III.

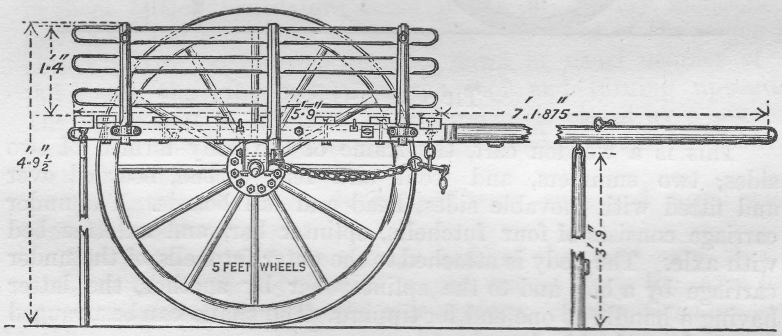
This cart differs from Mark II in having the shafts removable instead of being in one piece with the sides. The latter are parallel, and the shafts fit into sockets on their inner sides, and are retained by a pin.

The wheels are either No. 144 with iron nave, or No. 162 with wood nave, B pattern, third class, 5′ in diameter.

## Maltese Cart. Mark III. Special.

This cart has a series of longitudinal slats, bolted under the cross bars.

Fig. 35.




## Maltese Cart. Mark IV.

Is similar to the preceding, but is fitted with side raves, the axletree bed is lowered from 9″ to 6″, and moved 3″ forward.

Swingletree chains are fitted to the axletree for shaft mules when mule draught is used. The shafts of this cart are 1′ longer than those of Mark III.

### Forge Cart, Mark I.

This is a Maltese cart Mark I fitted to carry a bellows forge.

A side piece is fitted on each side of the cart over the cross bar, outside of the sides; a board to carry the anvil block is fitted in front, and there is a drawer secured in bands underneath the board and splinter bar.

The shafts are removeable.

The cart is fitted with bale hoops and canvas cover.

The forge is similar to the Field Forge Mark II, but the frame is of wood. It is secured in a similar manner to the latter.

### Forge Cart. Mark II.

This is a Maltese cart Mark II fitted in a similar manner to the above.

### Water Cart. Mark I.

This is a Maltese cart fitted with three bolsters to support a water barrel containing 108 gallons. The shafts are formed, as in the Maltese carts Marks I and II, by the prolongation of the sides. § 3782.

The barrel is fitted with a removeable gun metal tap screwing into a socket; a metal plug fitting this socket is supplied for use, when the tap is removed. A small block is fixed on each side of the barrel to prevent its turning, The barrel is secured on the cart by two wrought-iron bands sccured to the front and rear bolsters respectively. One end of each band is screwed and passes through the bolster, being secured by a thumb nut beneath. The other end is formed with a hook, which hooks into an eyebolt on the bolster.

The wheels are No. 143, A pattern, third class, 5′ in diameter.

### Water Cart. Mark II.

This cart is similar to Mark I, but the axletree arms are of the B pattern, and the wheels used are No. 144 or 162, B pattern, third class, 5′ in diameter.

### Water Cart. Mark III.

This cart is similar to Mark II but the shafts are removeable.

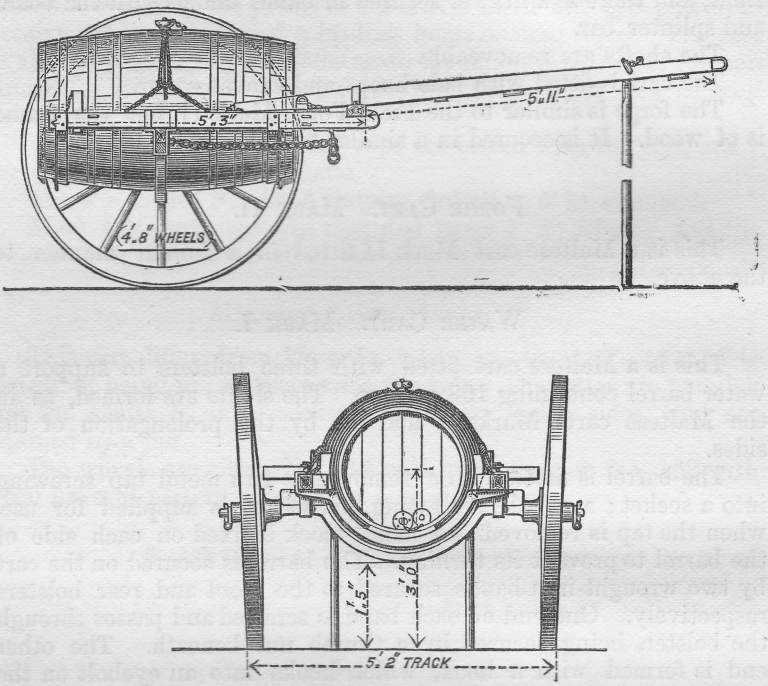
The wheels are No. 145 B, third class, 4′ 8″ diameter.

### Water Cart. Mark IV.

This cart consists of two sides of ash, connected by a curved axletree, two curved iron stays, a splinter bar and two slats. § 4550. R.C.D. photo-litho, 26A.

Each side is supported on a block of oak which rests on the axletree at the shoulder. A clip plate passes underneath the axletree, and is connected to the block by a bolt. Two bands with nuts secure the sides to the clip plate. The axletree is rectangular in section. The wheels are the same as those for Mark III cart.

Fig. 36.




The stays are wrought-iron of angle section, they are secured to the sides by bolts and screws, one put in at the rear of the slats, and the other at the rear end of the sides. Each stay carries a block of elm, fixed to it by screws, on which the barrel rests. To secure the barrel in position, elm cleats are fitted to the sides on the inside, elm wedges fit in slots in the cleats, and can be jammed against the barrel. The front wedges are attached by chains to the front slat and the rear ones to the sides. The front slat is bolted across the sides, and the rear slat across the front cleats in rear of the former.

The splinter bar is bolted over the front ends of the sides to the front of the slats. A stay of wrought-iron with an eye formed in its front end to take the hook of a swingletree connects the near side with the end of the splinter bar. The shafts pass through two wrought-iron bands on the splinter bar and rest over the front slat; the nib irons on their ends fit in sockets formed in wrought-iron brackets bolted on the sides. They are

secured each by a bolt, which is passed through the shaft from the inside and through a bracket on the side, to which it is secured by a nut.

A draught chain is fixed to each of the bolts passing through the blocks on the axletree shoulders, the front end of the chains are led through rings underneath the front of the sides.

The cart is fitted for mule draught similarly to the Maltese cart Mark IV.

Two rings are fitted on each side for the rope lashing securing the barrel.

The barrel is similar to that for the earlier patterns, but the bung hole is enlarged and a plate fitted with rings for the lashing rope is attached round it. A block is attached to the rear of the barrel to receive the metal screw-tap when withdrawn. The rope lashing for securing the barrel consists of 1″ tarred rope 20′ long on each side.

The shafts are fitted to take two slats for man draught, which when not in use are carried strapped along the outside of the off side. The grease tin is carried on the outside of the near side.

A tin funnel is issued with each cart.

## Forage Cart. Mark I.

Forage cart. § 5016. § 5124.

This is a small light cart with framework of ash and axletree bed of elm. It is fitted with folding sides, removeable head and tail boards, and fixed shafts.

It is also fitted for mule draught. The fittings consist of a chain fixed to each end of the axletree bed and united by a loop in the centre, to which a No. 3 swingletree is hooked. The loop passes through a triangular link suspended from the centre of the splinter bar. A sliding outrigger is let into the near side for double draught, and with each cart is issued a chain with hook and ring, which can be passed through the loop at the end of the outrigger and hooked on the drag washer. No. 3 swingletree is then attached to the ring.

The cart is furnished with front, hind and side ladders, bale hoops and a rear prop; also fittings for a grease tin, a reaping hook, and a leather bucket. A small locker is fixed underneath for carrying a linch-pin, washer, inventory board, lashing rope and spun yarn.

The wheels used with the cart are 3rd class B, 5′ diameter and 3″ width of tire, either No. 144 with iron naves, or No. 162 with wood naves.

## CHAPTER IV.—AMBULANCE CARRIAGES.

The following are the carriages for Army Hospital service:—

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | tons. |
| Wagon, ambulance, Mark III .. .. .. .. | 17 | 3 | 6 | 3·625 |
| Wagon, ambulance, converted, light supply .. .. | 18 | 3 | 2 | 3·164 |
| Wagon, field hospital store .. .. .. .. | 20 | 3 | 11 | 4·62 |
| Wagon, pharmacy .. .. .. .. .. | 18 | 3 | 0 | 8·292 |
| Wagon, surgery .. .. .. .. .. .. | 17 | 1 | 0 | 3·777 |
| Cart ambulance .. .. .. .. .. .. | 9 | 1 | 20 | 2·602 |

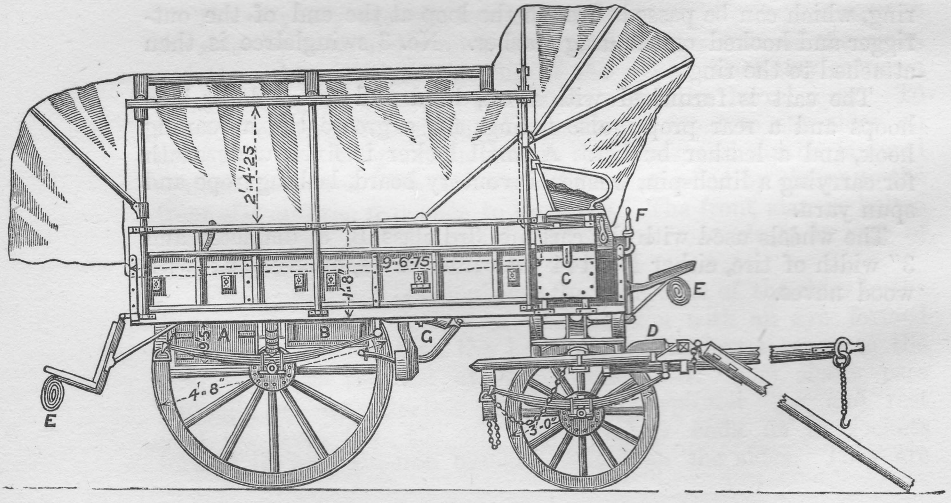
### Ambulance Wagon. Mark III.

Ambulance wagon. Mark III. L. of C., § 3161.

This wagon is constructed to carry two men on stretchers, three on a front seat, and three on the hind part of the wagon. It consists of a fore and hind carriage; the body of the latter is formed by an oak frame boarded with yellow deal, and fitted with low folding head and sides, the frames of which are of oak and the boarding of pine; the sides have also each a top rail of ash. To the hind earbed is attached a folding tail board of mahogany, to which a foot board of elm is hung by jointed stays. When the tailboard is down it is kept in position by stays underneath, and the foot board can then be used as such by men sitting on the hind part of the bottom of the wagon. The body is attached to its axletree by semi-elliptical springs, and has also a check spring under the centre

Fig. 37.

Scale about $\frac{1}{44}$ full size.



The framework of the fore carriage is of oak, the splinter bar and futchells are strengthened by plates of iron. It is supported upon three springs, one attached to the centre of the cross bar; the front extremities of the other two, which are side springs, to the outer futchells, and their hind extremities to the first-mentioned spring, which lies at right angles to them.

The splinter bar is fitted with frame shafts for double or single draught, and with links to take the trace hooks; the fore carriage is also fitted for pole draught. The linch-pins of the fore axle are formed each with a plate upon the head to serve as a step, another plate as step being placed on each end of the splinter bar and on each end of the front earbed of the body.

A movable seat of pine, with back of pine, back rail of mahogany, and side rails of iron, is secured across the top rails of the wagon sides in front, the footboard for which is attached by hinged joints to the head board.

A sliding partition, also of pine, with rail of mahogany, is fitted across the interior of the body towards the rear to serve as a back board for the hind seat.

A locker C, is formed on each side of the wagon to the front, the one on the off side with partitions for wine, that on the near side for tools and stores. Under the hind part of the wagon there are jointed iron bands in which a corn locker A, and water tank B, (for 9·6 gallons) are carried, the former accessible by two lids in the bottom of the wagon, the latter fitted with a leather tube and funnel.

The roof of the wagon consists of an angular frame of ash hinged together along the centre, and supported on rod standards of tubular galvanized iron, which fit into sockets on the sides of the wagon. Galvanized iron hoops are jointed to the front and rear standards for hoods, and the front standards are strengthened by jointed stays. The cover, curtains, and hoods are of canvas waterproofed.

A double screw brake G, worked by a cranked lever handle F, is fitted to act upon the hind wheels; a drag shoe is also carried.

The seats have cushions and leather aprons, E, and the front seat a driving box; the wagon is fitted with lanterns.

A ladder D, of ash, is carried upon the fore carriage, and when required to give access to the fore carriage it is attached to the front of the wagon by hooks.

There is a long partition board down the centre of the body, on each side of which a stretcher can be placed. To place a stretcher in the wagon, the backboard and cushion of the hind seat are removed, and the stretcher pushed into the wagon, running on the rollers in its feet; when home, the backboard and cushion are replaced.

Straps are fixed to the front and hind standards to carry stretchers, two being carried rolled up on each side. Straps are also attached to the centre of the roof to carry the pillows of the stretchers; also straps with buckles and three loops to the bottom of the wagon under each stretcher for securing rifles.

The wheels used with the wagon are, fore, third class, B, No. 152, 3′ diameter; hind, No. 148, 4′ 8″ diameter.

The following alterations have been made in certain wagons of recent manufacture.

The springs are strengthened and an additional check spring is added over the fore axle.

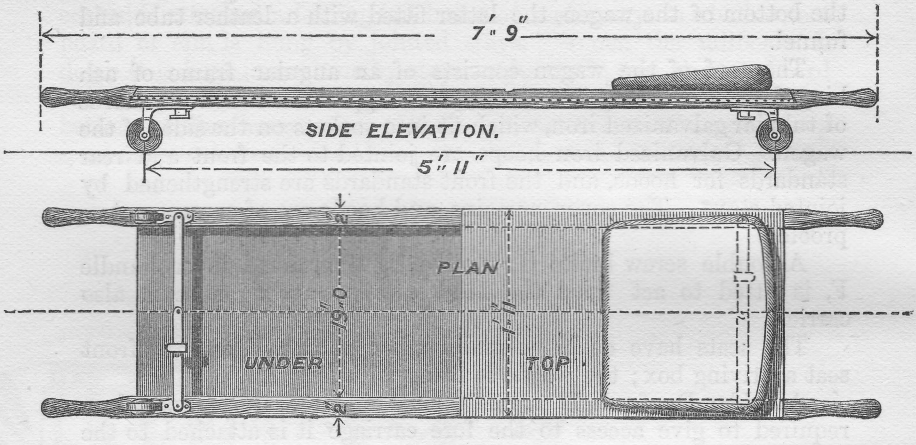
A lever brake is substituted for the screw brake; the foot board is widened and the guard irons are raised. The pole is fitted so as to allow of vertical play. The cleats on the head board are altered to suit the stretchers, Marks IV and V. The tubing of the roof is of steel.

Stretchers. L. of C., § 3157.

The stretcher, Mark III, consist each of a canvas bottom, tanned of a dark colour, connected to two ash poles, the ends of which are formed into handles, and which are kept at a fixed distance apart by two jointed stays of malleable cast steel. Each stretcher is fitted with four short folding legs also of malleable cast steel, the keys securing which are so formed as to hold them rigid when down: rollers are fitted in the extremities of the legs. Weight, 1 qr. 3 lbs.

Wrought iron was at first used for the fittings.

Fig. 38.




Stretchers Marks IV and V. § 4089.

Mark IV stretcher differs in the following points from Mark III.

The sliding ferule of the jointed bars is dispensed with, and rigid brackets with wood rollers 3″ in diameter are substituted for the folding legs with small metal rollers; the pillow varies in thickness from $3\frac{1}{2}$″ to $1\frac{1}{2}$″.

Mark V stretcher is similar to Mark IV, but the jointed bars are made of wrought-iron instead of malleable cast iron and are of a stronger section.

## Ambulance Wagon converted from Light Spring Wagon.

The light iron spring wagons, which were similar to the heavy iron spring wagons, but weaker, and with third class wheels and axles, have been converted to ambulances of Mark III pattern in arrangement and fittings.

Ambulance wagon, converted.

## Pharmacy Wagon. Mark I.

This is a light covered-in spring wagon, constructed to carry surgical instruments and appliances, medicines, and means of compounding, together with a small supply of medical comforts.

Pharmacy wagon. Mark 1. L. of C., § 3331. § 5043.

The frame of the body is similar to that of the ambulance wagon Mark III; the fore carriage, wheels and fittings for draught, are identical with those of the same wagon, with the exception that the pole is stronger, and its fittings allow of vertical play. The springs are similar to those of the ambulance wagon, but stronger, there being two additional leaves in each of the side springs, and one additional leaf in each of the cross springs.

The body forms a rectangular box, with an arched roof, and a locker in front, which serves as a driving seat.

The rectangular portion of the body is divided into five compartments, two opening to each side and one to the rear.

This rear compartment is a large one, and is closed by the tail board, which is made folding, so that when let down and supported by chains, it can be opened out to sufficient size to form a table for a dispenser to work at. This compartment is sub-divided and fitted with lockers running on rollers, which can be drawn out upon the tail board. The other compartments are smaller, and the front ones are fitted with drawers.

There are also two compartments in the arched roof.

A canvas hood is supplied with the wagon to protect persons employed at the tail board, and may be fitted when required, being supported on irons so arranged that when not in use they fold back on the roof. When not required, the hood is folded up and secured by straps. The wheels are the same as for the ambulance wagon.

## Field Hospital Store Wagon.

The G.S. wagon Mark IV is used to convey stores for field hospitals. When so appropriated, it is divided into three compartments by cross partitions, and the sides and tail board are increased in height by removeable floating boards.

Field hospital store wagon. L. of C., § 3330. R.C.D. photo-litho., 102.

A large locker is also attached under the rear of the wagon.

| | |
|---|---|
| Weight of additional fittings .. | 2 cwt. 0 qr. 6½ lbs. |
| „ tonnage of „ .. | 0·975 ton. |
| „ wagon when fitted.. | 20 cwt. 1 qr. 6½ lbs. |

In the middle compartment is carried a box to contain clothing; in the rear compartment four other boxes to contain

medical comforts, &c.; in the front compartment and over the others bedding is carried, kept in position by the floating boards.

### Surgery Wagon. Mark I.

Surgery wagon. Mark I. § 5367.

This wagon is on the same general plan as the G.S. wagon, Mark IV, but lighter and weaker in the frame, its width, and the height of the sides being at the same time increased to give greater capacity; the bale hoops are also higher.

It is mounted on semi-elliptical springs; the fore springs have eight leaves, and are attached to the fore carriage, as in the engineer wagons; the hind springs have nine leaves; and are attached to double strap irons, bolted to the sides and summers.

The wheels are the same as for the ambulance wagon.

The wagon is fitted with a pole similar to that of the pharmacy wagon with fittings to allow of vertical play.

### Ambulance Cart (Experimental).

This cart is constructed to carry either two men lying on service stretchers, Mark IV or Mark V, or four men in a sitting position.

The framework of the body of the cart is formed by two sides supported on springs over a cranked wrought-iron axletree, and connected by a splinter bar, shaft bars, and four cross bars, two in front and two in rear of the axletree. The spaces between the two front and rear cross bars and the sides are boarded over underneath, and a locker is formed between the two outer cross-bars over the axletree. Jointed foot and leg boards are hinged to the front and rear cross-bars.* The cart is fitted with sideboards, bale hoops and a canvas cover.

When the cart is arranged to carry the stretchers, a platform is formed by the sides of the cart, the lid of the central locker, two boards hinged to the two centre cross-bars, the front foot board which is folded up, and the hind leg board which is retained in a horizontal position. The pieces forming the platform are fitted with metal runners and wood battens to serve as guides for the stretcher rollers. A wood partition is fitted in the cart between the two stretchers. The hind leg board is supported in a horizontal position, by a stay pinned to a bracket beneath its centre, and also a bracket attached by fixed stays under the rear crossbars. The board is also supported by a steel bolt at each end, sliding in metal brackets fixed to its under side, which is pressed by a spring into a slot in the side of the body. The foot board is kept in a vertical position by two steel stays, the ends of which fit on nib irons on the body side boards. This board acts as a tail board to the cart and is fitted with four stops of india-rubber, against which the ends of the stretcher poles rest. The outside roller of the near stretcher rests on the near side of the cart, against a cleat fixed on the side to serve as a stop;

* The foot and leg boards, both front and rear, are now rigidly attached to the frame of the cart; the inside feet of the stretchers being supported by brackets hinged to the back boards.

the outer roller of the off stretcher rests on an iron bar, hinged to the off side, which is bent to form a stop. Stops for the inner rollers are fitted on the front footboard. The ends of the inner pole of each roller passes through a staple on a block on the front cross-bar. The front foot and leg boards are folded together and supported in a horizontal position by spring bolts, in a similar manner to the hind leg board.

When the cart is arranged to carry four men sitting, both front and hind foot boards are let down, the centre partition is removed, and the boards hinged to the centre cross boards are raised and form back rests. Cushions to form seats are fitted in the boarded spaces between the cross bars. The boards forming the back rest are supported by battens on the side boards, and are secured by three screws, which pass through the sides from the outside, and into screwed staples on the back rests. The front leg board is supported by steel stays, suspended from beneath the cart sides in front of the axletree, which are keyed on nib irons at the back of the board. The front foot board is supported by steel stays suspended from the front cross bar, which pass through the board and are nutted beneath by nuts with flaps which are attached to the board by chains. The hind leg and foot boards are similarly supported by steel stays, those supporting the foot-board being keyed to nib irons at the sides.

To facilitate access to the front seat, the off side of the cart is cut away between the front cross bars and the shaft bars, the two parts being connected by a bent bar of angle steel, fitted with a step. The hinged stop band for the stretcher roller is secured to the bar, where it joins the end of the side by a French key.

The cart is arranged for double draught. A draught spring is fitted to the splinter bar, having a staple at each end, which fits over the bar, and has an eye on the end to receive the hook of a swingletree.

The shafts pass through bands on the splinter bar, and their ends fit in sockets formed in staples on the shaft bar, where they are secured by a pin.

A small water tank and a box containing medical comforts are fitted at the rear of the cart underneath.

## Litters. Mark III.

Litters.
Mark III.
L. of C.,
§ 2520.

Litters are "near" and "off,"* and are formed each of a light iron frame with canvas bottom, and over the head a folding hood. Each litter is attached to the saddle by hanging bars, which are held apart by a cross stay. The hanging bars hook to the saddle and are secured by thumbscrews and a girth; while the litters are steadied by a strap passed round them and the body of the mule. A pillow is secured upon the head of each litter, and an apron over the body. The aprons are "near" and "off," Mark II.; weight of a pair, 4½ lbs.

* Litters can be used on either side of the pack saddle in the event of either "near" or "off" litters only being available. § 5232.

L. of C., § 2640.

When not required for use, the litters can each be folded in three, turned up against the mule's side and retained by a strap.

Weight of a pair of litters complete, 3 qrs. 22 lbs.

### Cacolets. Mark II.

Cacolets. Mark II. L. of C., § 3053. § 5230.

A cacolet consists of a light iron-framed seat attached to the saddle by hanging bars to which it is riveted. It is fitted with a guard iron on the outer side, and straps in front and rear to secure a sick or wounded man, also, with a foot rest slung by straps and with a cushion. When not required for use, it can be folded against the mule's side.

Cacolets are interchangeable, a pair weigh 56 lbs.

### Table, Operating, Field Hospital Equipment. Mark I.

Operating table, field hospital. Mark I. L. of C., § 3128.

This table consists of a top supported on four angle-iron folding legs with stays, a back rest, and two leg rests. The top is fitted with slides for the back rest, and cleats underneath to serve as slides for the leg rests. The back rest is secured in any desired position by a pin. The rest itself is hinged to a frame which moves in the slides on the table top; it is supported by a stay, the lower ends of which engage in racks on the frame; it can thus be fixed at any angle desired. When the table is packed the stays of the legs are removed and secured to the sides of the table by straps; the legs are folded under the table, the back rest folded down, and the leg rests pushed in.

Weight, 2 qrs. 21 lbs. Tonnage, ·089 ton.

### Table, Operating, Bearer Column.

Operating table, bearer column. Mark II. L. of C., § 3129.

This table is of wood throughout, and consists of a top and stand. The top has four short metal studs on the under side to fit into corresponding sockets in the stand. The stand is framed, and the ends are hinged to fold for packing.

Weight, 1 qr. 24 lbs. Tonnage, ·117 ton.

### Table, Operating, Folding. Mark I.

Table, operating, folding. Mark I. § 5234.

The table consists of a plain wood top in two pieces joined together by two iron strap-hinges. It is fitted at one end with two small iron hooks, and at the other two small studs are fixed.

These hooks and studs are for fastening the table when folded up.

### Boxes, Medical Comfort, and Canteens for Bearer Companies.

Medical comfort boxes and canteens.

There are five boxes issued for bearer companies (see Appendix No. 4, Medical Regulations, 1878). Two of these are known as boxes, medical comfort, divisional, Mark II, and are numbered 1

and 2. They are of wood, the lids are hinged, covered with canvas, and bound with iron. Each box is fitted with a lock and key, and with a cleat and rope grummet at each end; the bottom is strengthened by two longitudinal cleats, and is fitted with four gun-metal rollers.

No. 1 has internal fittings for 24 bottles. No. 2 contains tin boxes for tea, sugar, arrowroot, &c.

The other boxes are called canteens, hospital, and are lettered A, B, and C.

They are of similar construction to the medical comfort boxes, except that they are fitted with a wrought-iron flush handle at each end, instead of a rope grummet.

They contain various utensils for hospital use.

Their weights (fitted with tin boxes, &c.) and tonnage are as follows:—

| | | Weight. | | Tonnage. |
|---|---|---|---|---|
| | | qrs. | lbs. | ton. |
| Boxes, medical comfort | No. 1 .. .. .. .. | 1 | 20 | 0·099 |
| | No. 2 .. .. .. .. | 2 | 13 | 0·099 |
| Canteens .. .. | A .. .. .. .. .. | 1 | 18 | 0·112 |
| | B .. .. .. .. .. | 1 | 20 | 0·112 |
| | C .. .. .. .. .. | 1 | 27 | 0·135 |

# PART II.—GARRISON CARRIAGES.

## CHAPTER I.—WOOD GUN CARRIAGES.

Garrison gun carriages are of three descriptions; namely, common standing, rear chock, and sliding. In either description the carriages for the different natures of guns differ only in dimensions.

Sliding carriages are either casemate or dwarf, which differ from each other only in the height of the brackets.

The following are the wood garrison carriages in the service for rifled guns:—

Table.

| Nature. | Standing. | | Sliding. | | | |
|---|---|---|---|---|---|---|
| | | | Casemate. | | Dwarf. | |
| | Weight. | Tonnage. | Weight. | Tonnage. | Weight. | Tonnage. |
| | cwts. | tons. | cwts. | tons. | cwts. | tons. |
| 7″ R.B.L., 82 cwt. .. | — | — | 15 | 1·45 | 15½ | 1·95 |
| 7″ R.B.L., 72 cwt. .. | — | — | 14½[c] | 1·825 | 15 | 1·95 |
| 40-pr. R.B.L. .. .. | 13¾ | 1·80 | 10½ | 1·88 | 11½ | 1·68 |
| | 23¼[a] | 2·95 | | | | |
| 80-pr. R.M.L. .. .. | — | — | 15¼ | 1·65 | 15¾ | 1·85 |
| 64-pr. R.M.L., 71 cwt. .. | 8¾[c] | 1·936 | — | — | 14¾ | 1·28 |
| 64-pr. R.M.L., 58 cwt. .. | 14¾ | 1·94 | 11 | 1·61 | 14 | 1·50 |
| | 16[b] | 1·91 | | | | |

*a*. Converted non-recoil.
*b*. Depression.
*c*. Converted naval.

### I. Standing Carriages.

A standing carriage consists of two brackets, two axletrees, a transom, and four trucks.

Standing carriages. (See R.C.D. photo-lithographs, 32 and 62.) Construction.

The brackets are of oak or teak in one or two pieces; trunnion holes for the gun and steps to serve as fulcra for handspikes in elevating are cut in them. To prevent the wood spliting, in each bracket, at each side of the trunnion hole, there is a horizontal rivet. If a bracket is made in two pieces, the latter are connected by dowels and a joint bolt, which passes down from the top step of the carriage, and is nutted beneath.*

* Common wood carriages for the R.M.L. 64-pr., 71 and 58 cwt., and for the S.B. 32-pr. 58 or 56 cwt., used for repository drill will in future be fitted with malleable cast iron trunnion plates, secured to the brackets by flush bolts.

The transom, of the same wood as the brackets, is housed into the latter and secured by a horizontal rivet.

The axletrees are of oak, the body rectangular, and the arms cylindrical, each is housed into the brackets. The front axle is secured by two axletree bands and four boss-headed bolts keyed beneath; the rear axle by four rivets with countersunk heads. An iron band is shrunk on to the end of each arm, and a clout plate nailed beneath.

A horizontal tie rivet passes through the lower part of the brackets.

The trucks are of cast iron, the front 19″ and the rear 16″ in diameter; they are secured on the arms by iron linch-pins. The trucks for the carriage of the 64-pr. 71 cwt. R.M.L, which is converted from the naval carriage, are of elm.

Fittings.

The fittings of the carriage are, an eye bolt on each side, a square metal nut for the elevating screw bolted in the rear axle, a bed staple on the back of the transom with pin to secure the stool bed, and a leather loop for the priming wires on the left bracket.

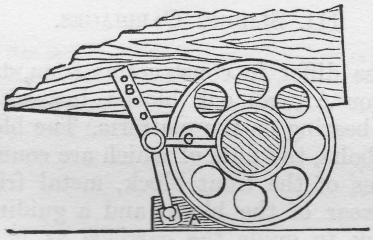
Articles belonging to.

The articles belonging to the carriage are "large" and "small" quoins of sabicu, a stool bed of wrought iron, and elevating screw of the ratchet head and lever pattern. The stool bed has a long groove in its under surface to take the head of the screw.

Allen's brake.

Allen's brake is fitted to the carriages for the 64 pr. 58 cwt. R.M.L. and the 8″ 65 cwt. S.B. It consists of a wooden wedge A, shod with iron, attached to the bracket immediately in rear of the truck by jointed bars of iron, the upper of which, B, is bolted to

Fig. 39.



the bracket, while from the joint another bar, C, passes horizontally through the axletree arm, forming the linch-pin. The wedge rests upon the ground in rear of the truck, following it as the carriage is run up, but on recoil it tends to jam under the truck. A rope lanyard is attached to the wedge, and an iron cleat upon the side of the carriage, so that, if it is wished not to use the brake, the wedge can be secured so as not to come into action on recoil. Weight of brake, complete, 1 cwt.

Depression carriages.

Depression carriages are a nature of standing carriage used with guns mounted at great elevations. The front part of the bracket is sloped away; they are fitted with capsquares and a moveable block across the rear steps, in which the elevating screw is held.

30° of depression can be given.

Non-recoil carriages.

The non-recoil carriage for the 40 pr. R.B.L. gun is converted from a naval mounting, which consisted of a top carriage and a slide. During recoil, the top carriage moved back along the upper surface of the slide, which had a steep slope. To adapt the mounting for the land service as a garrison standing carriage, the top carriage is fixed to the slide, and the latter is fitted with trucks. In some of these carriages the stool bed is supported in rear, in hanging plates formed with notches in which it rests. In others the hanging plates are plain, and are connected by a cross piece on which the stool bed rests. A different elevating screw and stool bed is used with each description of carriage. Figures of the carriages are given in List of Changes in war stores, § 1092 and § 1248.

## II. Rear Chock Carriages.

Rear chock carriages.

These are similar in general construction to standing carriages, but instead of a rear axle and trucks have a chock or block of sabicu or African oak.

Fittings.

The carriage fittings are an eye bolt on each bracket, and one on the rear of the chock; on the chock there is also, in rear, a handspike iron to take the roller handspike for running up, and on the upper surface a metal socket for the elevating nut; on the left bracket there is the usual leather loop for the priming wires.

Articles belonging to.

The articles belonging to the carriage are quoins, stool bed, and elevating screw, as for the standing carriage, except that the latter has an oscillating instead of a fixed nut, and consequently the groove in the under side of the stool bed is not elongated.

## III. Sliding Carriages.

Sliding carriages. (See R.C.D. photo-lithographs, 63, 60A, 60B.) Construction.

Sliding carriages differ in construction from standing carriages in having sabicu or African oak blocks, instead of axletrees and trucks, to take the bearing on the platform. The blocks are secured in the brackets by bolts, the nuts of which are countersunk. Under the bearing surfaces of the front block, metal friction plates are fixed to prevent wear of the block, and a guiding piece projects beneath each block to guide the carriage as it slides upon its platform. Two 8″ metal rollers to facilitate running up are secured in wrought-iron flanges bolted upon the front of each bracket. An eye is fixed near each end of the rear block, and a notch for a pawl in the rear of each bracket to take a truck lever for running up. When by the truck levers the rear of the carriage is raised 2″ the front rollers should come into play, and when the carriage rests upon its blocks the front rollers should have a clearance of $\frac{3}{16}$″.

Fittings.

The fittings of the carriage are two eye bolts for tackle on each bracket, an eye plate on the rear block for the preventor rope, or for the pintail of the transporting dilly, a hole through the front block to receive the transporting axle, a socket for the elevating screw, a

loop for the priming wires, and in the 7″ R.B.L., a loop for the tin cup extractor.

Articles belonging to.

The elevating screw, &c., is the same as for rear chock carriages.

The upper side steps are cut away iu carriages for R.B.L. guns, except the 40-pr.

§ 4484.

Sliding carriages, both wood and iron, have been placed in a numbered series (see p. 495). Carriages, Nos. 15 to 25 of this series are of wood. Such carriages in future when issued will have the distinguishing number employed in their designation marked on their inscription plate.

§ 4533.

Carriages issued previously to June, 1884, are marked with their distinguishing numbers on the left side immediately under the inscription plate.

## CHAPTER II.—BEDS FOR HOWITZERS AND MORTARS FOR GARRISON SERVICE.

Tht following beds are in the service for howitzers and mortars :—

| Nature. | | Weight. | Tonnage. |
|---|---|---|---|
| | | cwt. | tons. |
| Howitzers— | | | |
| R.M.L. | 8″ 46 cwt. | 33 | 1·403 |
| | 6·6″ | 31 | 1·379 |
| | 6·3″ | 31¼ | 1·379 |
| Mortars— | | | |
| 13″ | 100 cwt. Sea service, wood | 60½ | 3·33 |
| | 100 cwt. Naval, for L.S. | 81¼ | 2·775 |
| | 36 cwt. iron | 32¾ | 1·22 |
| 10″ | 52 cwt. naval wood for L.S. | 48 | 2·5 |
| | 18 cwt. iron | 17¾ | ·56 |
| 8″ 9 cwt. iron | | 8¾ | ·29 |
| 5½ inch, wood | | 1 | ·11 |
| 4⅘ inch, wood | | ¾ | ·04 |

### 6·3″ R.M.L. Howitzer Bed. Mark I.

6·3″ R.M.L. howitzer bed. L. of C.. § 3506. §4364, R.C.D. photo-litho. 58.

The bed for the 6·3″ howitzer consists of two double plate brackets with wrought-iron frames and steel plates, connected by a bottom plate, and front and rear transoms; it rests upon six metal rollers with steel axles. It stands over a "directing bar," the bottom plate being attached sufficiently high up to allow the directing bar to lie below it, between the brackets.

The directing bar is built up of channel and plate iron, and has a hinged metal flap in front, which fits over a pivot in the ground platform.

It has stops in front and rear to check the bed in running up or on recoil; and, in rear, an eye by which it can be hooked up for transport to an ordinary siege limber. It also has two compressor bars on each side.

The bottom plate of the bed is slotted to admit three compressor plates on each side, which hang down below it, and between which pass the compressor bars of the directing bar. The inner compressor plates have their lower edges turned inwards at right angles, so as to form clips. When the howitzer is fired, the bed is allowed to jump the height of the bar, the clips are then caught by a projecting plate which forms the upper surface of the bar, so that the bed is prevented from becoming detached from the latter.

As the bed recoils, it is brought down to its proper position on its rollers by inclined surfaces, which act upon the clips of the compressor plates, and which are formed by the sloping fronts of short plates on the bar.

Over the compressor plates in the bed lies a bow or cramp, the arms of the bow passing down below the bottom plate. Two screw shafts pass through metal bushed bearings in the brackets of the bed, and screw into holes in the arms of the bow, their ends abutting against the outer compressor plates. The shaft on the left side has a compressing lever on its extremity, and when this is worked the end of the screw shaft is pressed against the compressor plate; at the same time it pulls over the bow, so that the end of the screw shaft on the right side is made to press against the plates on that side, a sufficient amount of friction being thus set up to check the recoil. Two plates are fixed on the bottom plate to prevent the compressor plates shifting when the bed jumps on recoil. The shaft on the right side carries an adjusting lever, which can be keyed in any position to an arc riveted to the bracket of the bed.

The compressor lever also works on an arc, which has a projection under which the lever catches when the compression is on.

The directing bar is made tapering in front, so that the motion of the bed is not checked during the first portion of the recoil.

The bed is fitted with worm wheel elevating gear, with friction cone, on the right side. There are three spur pinions in the gear.

The height of the axis of the trunnion holes is 3′ 0·5″, and 70° of elevation can be given to the howitzer, a second hole for this purpose being drilled in the arc. The bed is used with the ground platform, described p. 99.

§ 4002. For transporting the bed and platform the following stores are required:—

| | | |
|---|---|---|
| Axletree, transporting | | 1 |
| Brackets with shackle | right | 1 |
| | left | 1 |
| Block, wood, trunnion | | 1 |
| Chain, shoe drag | | 1 |
| Clip, transom, with chain and loop supporting directing bar | | 1 |

| | | | |
|---|---|---|---|
| Key, flat, with chain for pin, securing directing bar .. .. .. .. .. .. | | | 1 |
| Pin, with chain, securing directing bar .. .. | | | 1 |
| Wheels, travelling, 1st class B, No. 6. .. .. | | | 2 |
| Shoe drag, 1st class .. .. .. .. | | | 1 |
| | Length. | 6·6″ or 6·3″ | |
| Rope lashing, tarred, $1\frac{1}{2}$″.. .. | 64′ | | 1 |
| | 50′ | | 3 |

To prepare for travelling, the bed is run up to the front of the directing bar, the compressor lever put down tightly, and the bar secured to the bed by the clip, which is placed on the front transom, the loops of the chains being attached to the pivot flap joint by the pin of the latter, which passes through them. The bar is also secured by the pin, which passes through the bottom plate of the bed and the bar, and is keyed beneath.

The axletree is passed through square metal bushed holes in the brackets of the bed, and is keyed on the outside of each, the wheels placed on the arms, and the rear end of the bar, limbered up to an iron siege limber, similar to that used with the 40-pr. R.M.L. carriage, &c., but which is fitted with one box.

This box is 4′ $8\frac{1}{4}$″ × 2′ $4\frac{1}{2}$″ × $16\frac{3}{4}$″; it is secured both in front and rear by straps, the front straps being buckled to loops attached to screw loops on the footboard. It has no lock, the lid is secured by two hasps and turnbuckles. In the box are carried the elevating gear, metal flap and pivot for directing bar, capsquares, rollers, &c.

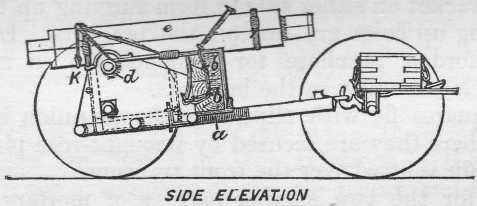
When the bed is prepared for transport by sea, the box also takes the compressor gear.

The rollers are removed from the bed, and the brackets (*a*) are put in the place of the rear ones and secured with their axles.

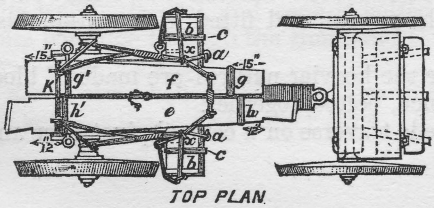
The transoms (*b*) of the platform are placed on these brackets in rear of the bed, the rear transom at the top; the housings are placed towards the bed, and they are lashed together at each end through their housings.

The wood trunnion block (*d*) is placed in the trunnion holes of the bed.

Fig. 40.




SIDE ELEVATION




TOP PLAN

The baulks of the platform (*e*) and (*f*) are lashed together in pairs, and placed flat on the transoms and trunnion block, the rear ends of the baulks on the latter. They are secured (1) by a lashing (*k*) passed round the rear ends at the rings, and made fast; (2) by a lashing on each side passed through the rings on the top baulks in rear, round the ends of the trunnion block, through the rings on the top transom (*x*, *x*) and brackets (*a*, *a*), back again and made fast; (3) by a lashing in front to the loops on the bed.

### 6·6″ Howitzer Bed.

§ 4364.

The bed for the 6·3″ howitzer has also been approved for the 6·6″ howitzer. The elevating gear is different for the two howitzers. When the bed is fitted for the 6·6″ howitzer, one pinion and two friction rollers are supplied; when for the 6·3″, three pinions and one friction roller. The arcs for the two howitzers are also different.

### 8″ R.M.L. Howitzer Bed.

8″ R.M.L. howitzer bed. L. of C., §§ 3130 and 3453. Photo-litho., 59.

The bed for the 8″ howitzer of 46 cwt. is similar generally to that for the 6·3″ howitzer, but lower, the height to the axis of the trunnion holes being only 2′ 6″. The plates of the brackets are of wrought-iron instead of steel, and the bottom plate is bent upwards, so as to form a recess for the directing bar. The latter is also similar to that for the 6·3″ howitzer, but wider.

The compressing and elevating gear and other fittings, and the transporting arrangements, are also the same as before described.

L. of C., § 3512.

45° of elevation can be given to the howitzer, but it should not be fired with less than 20° of elevation.

### Mortar Beds.

Iron beds.

The iron beds are of cast-iron, with wrought-iron capsquares. Each consists of two brackets and two transoms, held together by rivets. In the beds for the 13″ and 10″, two of the rivets project beyond the bracket on either side to form running up bolts; in the 8″ bed running up bolts are cast on the brackets. In all natures a horn, to afford a purchase for a handspike in traversing is formed on each extremity of the brackets.

The capsquares fit with clips over the trunnion holes in slots on the bed, where they are secured by wrought-iron pins.

A wood coin is fitted over the front transom.

Wood beds.

The beds for the two smaller natures of mortars are formed each of a block of sabicu or African oak, hollowed out to receive the breech of the mortar, and fitted with capsquares, a quoin, and rope handles.

The beds for the heavier natures are made of blocks of African oak, teak or sabicu, bolted together.

The naval beds traverse on a central pivot over an octagon deck

of wood, which is supported on buffers of india-rubber, about $2\frac{1}{2}''$, which takes the shock of the discharge. When employed for L.S. the beds are mounted with their octagon decks on wooden ground platforms.

S.S. wood beds for L.S. R.C.D. photo-litho., 78.

## CHAPTER III.—WROUGHT IRON STANDING CARRIAGES.

There are two natures of wrought-iron standing gun carriages, identical in construction and interchangeable in all their parts, excepting the transom bolts.

They are denoted respectively No. 1 and No. 2.

| Nature. | Weight. | Tonnage. | Width between Brackets, &c. | Height of axis of Trunnion (about). | Trucks. | | | Guns which the carriage will mount. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Diam. of Fore. | Diam. of Hind. | Track of Fore and Hind. | |
| | cwts. qrs. lbs. | tons. | in. | in. | in. | in. | in. | |
| No. 1 | 17 1 0 | 1·25 | $26\frac{1}{4}$ | $39\frac{1}{2}$ | 20 | 18 | 54 | R.M.L. 64-pr., 64 cwt.* Mark I, and 71 cwt.<br>S.B 8-inch, 65 or 54 cwt. |
| No. 2 | 17 1 0 | 1·25 | $22\frac{1}{4}$ | $39\frac{1}{2}$ | 20 | 18 | 54 | R.B.L. 40-pr.<br>R.M.L. 64-pr., 58 cwt.<br>S.B 32-pr. 58 or 56 cwt. |

* The carriage will also take Marks II and III, though they do not fit it accurately.

### No. 1 Carriage. Mark I.

The body of the carriage consists of two skeleton brackets connected by a fore and hind axletree, and by two transom bolts.

No. 1 carriage (See R.C.D. photo-litho-graph, 64.)

Each bracket is formed of three double stays of plate iron bolted at their lower ends to a tie piece of tee iron, and at their upper to a simicircular piece, also of tee iron, which forms the trunnion holes.

The body of each axletree is of girder iron, the arms being bolted to it. Recesses are formed for the axletrees in the brackets by bending down the extremities of the tie pieces, and bolting knees underneath the latter; the fore axle is placed with its web vertical, the hind with its web horizontal, and each is bolted in its position. The transom bolts pass, one through the front, and the other through the middle stays of the brackets.

The trucks are of elm, shod with a ring tire and bouched with metal; they are kept on the arms by linch-pins.

Fittings. Two iron steps are bolted upon the hind stay of each bracket to serve as fulcra for handspikes, when the latter are used in elevating.

The body of the hind axle is filled in with wood between the web and the flanges, and recessed to receive the elevating screw nut.

The second transom bolt is shaped to receive the front end of the stool bed, and a pin is chained to it for securing the latter.

Beneath the hind axletree two blocks of sabicu are bolted, so that by removing the hind trucks the carriage can be converted into a "rear chock" carriage, while behind the axle a handspike iron is attached for the roller handspike then required.

To reduce the size of the trunnion holes and the distance between them, and thereby adapt the carriage, when necessary to take the 64-pr. of 71 cwt., or the 8″ S.B. guns, there is a semi-circular plate, with projecting shoulder, to fit each trunnion hole. The plates are each stamped "8 inch."

Marking. Upon the upper surface of the hind axletree are stamped the natures of guns for which the carriage is intended, the mark, date of manufacture, and weight.

Articles belonging to. The elevating screw is the "ratchet head and lever," already described in Part I; it has a square nut, which is let into and bolted in the hind axle.

The stool bed is of wrought-iron 2′ 8½″ long from the centre of the pin hole in front to the centre of the groove in rear.

The quoins, "large" and "hand," are of sabicu, the former plated where it takes the bearing of the breech of the gun.

Cast-iron trucks are issued to replace the wooden trucks when the carriage is not in use, in order that the wooden may be placed in store and protected from the effects of climate.

## No. 2 Carriage. Mark I.

No. 2 carriage. Construction. This carriage differs from No. 1 only in having the brackets placed 4″ nearer to each other, the transom bolts being consequently that amount shorter than those of No. 1 carriage. The same axletrees serve for either carriage, but require fresh bolt holes to be drilled in them to suit the altered position of the brackets.

Fittings. As No. 2 carriage is intended for different guns to No. 1, its trunnion hole fitments are necessarily different to those of the latter carriage, thus :—

To make the carriage suitable for the 40-pr. R.B.L. gun there are trunnion plates similar to those for the 8″ S.B. in No. 1 carriage.

To adapt the carriage for the 64-pr. R.M.L. or 32-pr. S.B. of 58 cwt. there are trunnion plates without a projecting shoulder, while for the 32-pr. S.B. of 56 cwt., in addition to these latter, there are collars to place over the trunnions of the gun.

All the above fitments are marked with the nature of gun with which they are to be used.

# CHAPTER IV.—IRON SLIDING CARRIAGES FOR R.M.L. GUNS 7-INCH TO 12·5-INCH.

## Single Plate Carriages.

The first wrought-iron carriages manufactured were made on what is known as the single plate construction. Each bracket was formed by a wrought-iron plate riveted to a frame of angle iron.

Single plate carriages have been made of two different patterns, known as "Pattern I" and "Pattern II."

In the following table the patterns of each nature are not shown separately, as in weight they are almost identical:— Table.

| Nature. | Weight. | Tonnage. | Diameter of Rollers. | |
|---|---|---|---|---|
| | | | Front. | Rear. |
| | cwts. qrs. | tons. | in. | in. |
| 7″ R.M.L. casemate .. .. | 27 3 | 1·720 | 10 | 6 |
| ,, dwarf .. .. .. | 29 0 | 1·770 | 10 | 6 |
| 9″ R.M.L. casemate .. .. | 37 0 | 2·260 | 12 | 8 |
| ,, dwarf .. .. .. | 39 0 | 2·875 | 12 | 8 |
| 12″ R.M.L. casemate .. .. | 57 2 | 4·383 | 12 | 8 |
| ,, ,, fitted with N.P. elevating gear and for buffer. | 60 3 | 4·914 | 12 | 8 |

Pattern I carriages were built up of two single plate brackets, front and rear blocks, and a transom. The blocks were formed of angle iron frames, over which plate iron was riveted. Pattern I carriages. L. of C., § 1584.

Of this pattern both casemate and dwarf carriages were made for the 7″ and 9″ R.M.L. guns.

They were fitted for the American compressor, which differed from the Elswick compressor for Pattern II single plate carriages, in the following respects:—

Instead of iron bars on the platform, there were five wood baulks, the centre one of which was fixed, so that it was necessary to put on the compression on both sides of the carriage before firing; the screw shafts had handwheels instead of levers on their outer ends, and the forms of the rocking levers and other parts were different.

The elevating arc in the earlier carriages was rigidly attached to the gun, and worked in a guide on the carriage, and was moved through a train of wheels by a handwheel.

Before many of these carriages were issued, they were found to be deficient in rigidity, and the remainder before issue were stiffened by knee stays and other additions, and were known as "Pattern I strengthened." In them the capstan head elevating gear (described further on for the double plate carriages) was adopted.

Pattern II carriages. L. of C., § 1584.

All carriages of this pattern are now considered to be unsuitable for the service, and they are being withdrawn.

Pattern II single plate carriages differ from Pattern I in having the brackets connected to a plate, termed the "bottom plate," instead of by blocks.

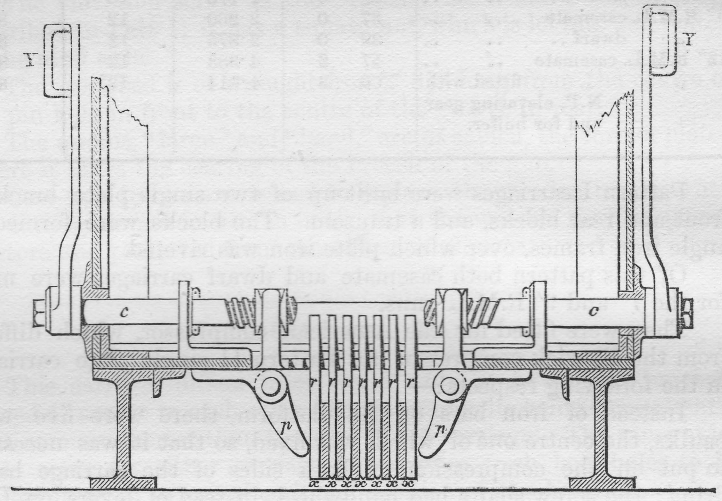
Each bracket is formed of a frame of angle iron and a stay of tee iron, to the outside of which an iron plate is riveted. The brackets stand on the bottom plate, to which they are bolted, and to make the carriage rigid a transom and two knee stays are added, as in the double plate carriages. As in the latter carriages, there is an angle iron stay across the bottom plate, and guides underneath.

The 12″ carriage differed slightly in its construction from the lower natures in having a second transom instead of knee stays in rear to support the brackets.

Fittings.

The "capstan head" elevating gear was used with the second pattern single-plate carriages, and they were fitted with the compressor known as the "Elswick compressor for single plate carriages," which is, however. replaced by the hydraulic buffer when a carriage is returned for repair to the Department.

Fig. 41.




The compressor, "E.O.C. for single plate carriages."

In principle the compressor is the same as the American, but is so arranged that compression before firing is put upon one side only of the carriage, while upon the other side the amount of the compression put on can be adjusted to any required degree. The compressor may be briefly described as follows:—

Six bars of plate iron, *x*, *x*, *x*, are hung on pins in the front and rear of the platform, and are all capable of transverse motion.

Seven iron plates, *r*, *r*, *r*, hang through an opening in the bottom plate, and rest in front upon the angle iron of the transom, and in rear upon a supporting bar, which is laid across the bottom plate, and, when the plates are in position, secured by two stops. The

plates and bars are compressed together by rocking levers, *p*. *p*, worked by screw shafts, *c*, *c*, which are moved by levers, Y, Y. The screws on the shafts are of different pitch, that on the right, which is called the compressor shaft, is quicker than that on the left, which is called the adjusting shaft. The levers work each along an arc riveted to the bracket of the carriage, the adjusting lever of iron can be keyed in any position on its arc, and the compressing lever of steel, when the compression is on, is caught under a projection on its arc. By pushing down the compressing lever under its catch the whole of the plates and bars are jammed by the right or compressing rocking lever against the left or adjusting rocking lever, the position of which is adjusted by its lever, according to the amount of compression required. The compressor is made self-acting by extending the lower end of the lever so that, on recoil, it will trip against a piece of iron fitted on the platform, and thereby throw the upper part of the lever down into the compressing position. An elastic pad is fitted on the bracket of the carriage, to receive and stop the compressor lever when it is thrown down.

### Converted Naval Carriages.

A number of naval single plate carriages for the 7″ R.M.L. gun of 6½ tons have been prepared and issued for land service at certain stations abroad. § 3835.

The carriage is adapted for the L.S. dwarf traversing platform, and is altered and strengthened in the following manner.

The fittings for the Elswick compressor are removed.

The bottom plate is strengthened at the front, and a bracket for a hydraulic buffer added.

A rear eccentric shaft with central bearing is added instead of the short eccentric axles.

Stop plates for iron pointed levers are added.

Sockets are fitted for iron pointed levers of the pattern for garrison service. § 2904.

Some naval carriages for 7″, 8″ and 9″ R.M.L.* have been converted for land service and are mounted on traversing platforms converted from naval slides. § 5101. § 5102. § 5103.

The conversion is similar for each nature of carriage. The E.O.C. compressor is removed, and a hydraulic buffer, the piston rod of which is in tension during recoil, is fitted under the bottom plate.

The cylinder of the buffer is of steel 5′ 9″ long for the 8″ carriage, 6′ 3·375″ for the 9″, internal diameter 6·07″, and rather less than ½″ in thickness; it is closed at each end by a W.I. cap. The piston and piston rod are of W.I., the piston is screwed on the rod, and has four holes in it, which are ·54″ diameter for the 8″ carriage, and ·5″ for the 9″. The cylinder for the 7″ carriage is 5′2″ long, and 4·052″ internal diameter: the piston for the 7″ has three holes, ·3″ diameter. A stuffing box is formed in the front cap at the end of which is placed round the piston rod a cup leather, kept in posi-

* The 7″ is a double plate, the 8″ and 9″ are single plate carriages.

tion by an inner metal gland screwed into the box. Packing of white cotton rope is placed round the piston rod in a recess in this gland, and is kept tight by an outer screw gland which screws into the first. There is a filling hole in top of the cylinder in rear, and a metal draw off valve underneath in rear of the front cap.

The buffer is supported by a metal bracket in rear formed in two parts, which clips and is bolted to the bottom plate of the carriage, and by a W.I. band in front. There are two nuts on the end of the piston rod, by which it is secured to the front of the slide.

### Double Plate Carriages.

The following table gives the double plate carriages for R.M.L. guns 7″ to 12·5″ in the service.

Table.

| Nature. | Weight (with gear). | Tonnage. | Diameter of rollers. | | Brackets. | |
|---|---|---|---|---|---|---|
| | | | Front. | Rear. | Height to axis of trunnions. | Distance between. |
| | cwts. qrs. | tons. | in. | in. | in. | in. |
| 7″ R.M.L. of 7 tons, fitted for E.O.C. compressor | 30 3 | 1·700 | 10 | 6 | 31·125 | 35·625 |
| 7″ R.M.L. of 7 tons, fitted for buffer | 27 3 | 1·975 | ,, | ,, | ,, | ,, |
| 9″ R.M.L. of 12 tons, fitted for E.O.C. compressor | 44 2 | 2·600 | 12 | 8 | 31·500 | 42·1875 |
| 9″ R.M.L. of 12 tons, fitted for buffer, O.P. elevating gear | 40 0 | 3·050 | ,, | ,, | ,, | ,, |
| 9″ R.M.L. of 12 tons, fitted for buffer, N.P. elevating gear | 42 1 | 3·114 | ,, | ,, | ,, | ,, |
| 9″ R.M.L. of 12 tons, Elswick pattern, fitted for E.O.C. compressor | — | — | 10 | 8 | ,, | ,, |
| 9″ R.M.L. of 12 tons, Elswick pattern, fitted for buffer | 35 3 | 2·817 | 10 | 8 | 31·500 | 42·1875 |
| 10″ R.M.L. of 18 tons, fitted for buffer. Mark I (high) | 51 1 | 3·747 | 12 | 8 | 33·5 | 47·7000 |
| 10″ R.M.L. of 18 tons, fitted for buffer. Mark II (low) | 67 0 | 4·639 | 13 | 8 | 23·0 | 49·5000 |
| 10″ R.M.L. of 18 tons, small port.. | 120 0 | 4·995 | 12 | 8 | 44·875 / 32·875 | 47·0000 |
| 11″ or 12″ R.M.L. of 25 tons, fitted for E.O.C. compressor, O.P. elevating gear | 68 2 | 4·675 | 12 | 8 | 41·0 | 57·2500 |
| 11″ or 12″ R.M.L. of 25 tons, fitted for buffer, O.P. elevating gear | 64 0 | 5·225 | ,, | ,, | ,, | ,, |
| 11″ or 12″ R.M.L. of 25 tons, fitted for buffer, N.P. elevating gear | 67 3 | 5·225 | ,, | ,, | ,, | ,, |
| 12″ R.M.L. of 35 tons, fitted for buffer | 115 1 | 7·723 | 13 | 12 | 36·75 | 60·7500 |
| 12·5″ R.M.L. of 38 tons, fitted with buffer | 123 2 | 7·723 | 13 | 12 | 36·75 | ,, |
| 12·5″ R.M.L. of 38 tons, small port 6 ft. recoil | 193 3 | 9·566 | 12 | 10 | 48·0 / 32·0 | ,, |
| 12·5″ R.M.L. of 38 tons, small port 7 ft. recoil | 206 3 | 11·25 | 12 | 10 | 48·0 / 32·0 | ,, |

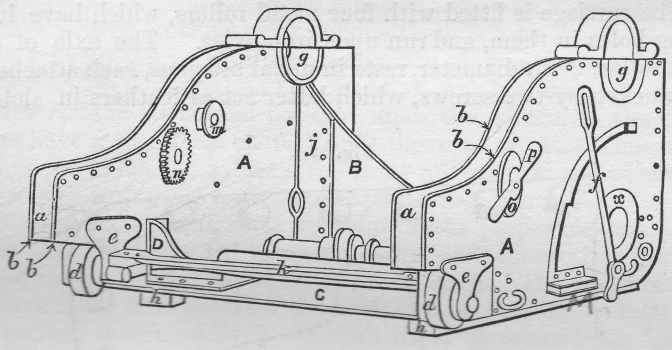
The distance between guides, from outside to outside, is in all cases $\frac{1}{32}$″ less than the width between the sides of the platform.

## 7″ R.M.L. of 7-Tons Carriage. Mark I.

This carriage is formed by two brackets, A, A, connected by a bottom plate C, and transom B, and strengthened by two stays, D, D.

7″ R.M.L. of 7 tons carriage. Mark I. (See R.C.D. photo-lithograph, 61B.) Construction. § 1635.

Fig. 42.




Each bracket A is made of a frame *a*, to each side of which a plate *b*, *b*, is riveted. The frame is of bar iron $3\frac{1}{2}$″ wide, forged to the required form and planed on each side; a packing piece also of bar iron is fitted vertically between the sides of the frame at the position of the transom. The plates are each $\frac{3}{8}$″ in thickness and are riveted to the frame, the surfaces being first coated with Pulford's black; they correspond to the latter in general form, but project beyond it in front and rear to form recesses for the carriage rollers. The top and under surface of each bracket is planed; when the carriage is complete and mounted upon its platform, the under surface having a slope of 4°, the upper will be horizontal and the ends vertical. Holes are cut in the brackets for the various fittings.

Two $\frac{3}{4}$″ holes are drilled through the outer plate of each bracket, near its lower edge, one in front and one in rear of the packing piece to allow water to escape. § 3471.

The bottom plate C is $\frac{7}{8}$″ thick, it has guides, *h*, *h*, of angle iron riveted along its under surface, which fit between the sides of the platform, when the carriage is mounted, and keep it in a true position during recoil or running up. The rear ends of the guides are bent round at right angles to form carriage stops. If the carriage is fitted for the Elswick compressor, an opening for the plates is cut in the bottom plate and a bar of angle iron riveted across just in rear of the opening, to stiffen the plate. The bottom plate is planed where the brackets rest upon it.

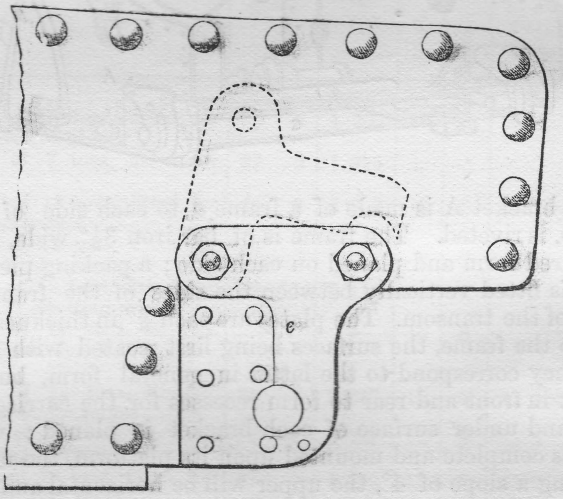
The transom B is formed of plate iron $\frac{5}{8}$″ thick riveted along the lower edge and the sides to a frame, *j*, of angle iron, the upper edge of the plate is curved to admit the gun.

The knee stays D, D. are of scrap iron, one supports each bracket in rear and stengthens its attachment to the bottom plate. Each stay is bolted to the bottom plate and riveted to the bracket.

The brackets stand upon the bottom plate and are secured to it by screws, the heads of which are countersunk. The transom also stands upon the bottom plate, an angular packing piece being between them, and is bolted both to it and to the brackets, supporting the latter in front. The bearing surfaces of the bottom plate and angle guides are planed so that the carriage may slide smoothly upon its platform.

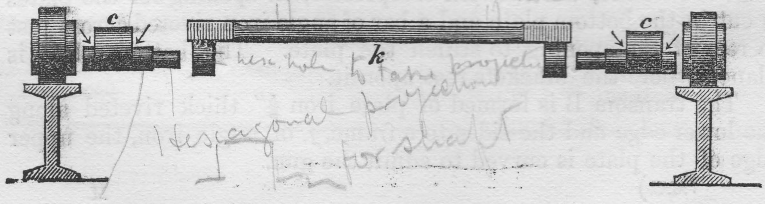
The carriage is fitted with four metal rollers, which have lubricating holes in them, and run upon iron axles. The axle of each front roller, 2″ in diameter, rests in metal bearings, each attached to the bracket by two screws, which latter act as feathers in slots in

Fig. 43.




the head of the axle and prevent it turning round in its bearing: the axle is put in from the outer side and keyed upon the inner with a galvanized iron key. The axles of the rear rollers, *d*, *d*, are eccentric, 3·258″ in diameter, and are secured in the brackets by what are termed "drop plates," *e*, *e*, in such a manner that they can be readily removed, namely, by taking out the rear bolts of the drop plates, and turning the latter upwards (see Fig. 43) upon their

Fig. 44.



front bolts as pivots, when the axles are freed. The axles *e*, *e*, are united by a bar, termed the "connecting bar," *k*, so that when worked they may move simultaneously. In the bar there are two holes for the reception of iron-pointed levers, by which the bar can be turned and the rollers thrown into or out of gear as desired. The inner end of each axle is made hexagonal in order that a socket to receive the iron-pointed lever may be fitted upon it in place of the connecting bar, should the latter be damaged. To give greater strength the metal of the axle is now rounded at the angles indicated in the figure by the arrows. In the carriages first made the axles were not connected by a bar and the rollers were worked by sockets fitted on their axles outside the brackets. § 2872.

To prevent the rear rollers coming into play in the recoil of the carriage a stop is riveted on the inside of each bracket. When the carriage rests in its normal position upon the platform, the front rollers have a clearance of ·05″ and the rear of ·1″. The metal bearings in which the axles of the front rollers rest are eccentric, so that by turning the bearings the position of the roller axles can be adjusted as required, so as to maintain the proper clearance. R.C.D. Instruction Plate CXXIII.

In later carriages the eccentric axles and connecting bar are formed in one forging called an eccentric shaft. The ends of this shaft are made hexagonal for the reception of sockets to take the iron pointed levers, while in the shaft itself there are holes for the same levers in case of the sockets being damaged. The shaft is supported at its centre by a metal bracket bolted to the bottom plate. § 2962.

The sockets are bent outwards from the carriage for the purpose of allowing the iron pointed levers to clear the side arm brackets and sponge tank, when brought down for running up. A pawl fitted with a handle is fitted to each socket. When the levers have been brought down, and the carriage raised on its rollers, the pawls can be lifted by the handles so as to engage the stop plates and thus prevent the carriage coming down off its rollers. § 2791.

The ecccentric shaft will for future manufacture be 2″ shorter outside each bracket. The stop plates have been strengthened by augmenting their width, increasing the number of rivets securing them to the carriage brackets, and shortening the stops to suit the shortened shaft. § 3781.

Elevating gear is fitted on each bracket, and the gun moved by working both sides simultaneously. On each side (see Fig. 42) it consists of,— Elevating gear.

A wrought-iron elevating arc (not shown in Fig.).
A pinion *n*, 7·91″ in greatest diameter, fixed to a spindle, both of wrought iron.
A metal friction roller *m*, attached to an iron spindle, with metal nut and steel pin.
A capstan head *o*, of wrought iron.
A clamp *p*, of wrought iron.

The elevating arc is pivoted to the gun and passes on the in-

side of the bracket between the friction roller and the pinion; it has teeth upon its rear edge, which gear in the teeth of the pinion, and a groove upon the front for the roller to run upon, so that the latter not only keeps the arc in gear with pinion, but prevents it moving from the side of the carriage. The spindles of the friction roller and pinion pass through the bracket, the former is secured by a metal nut and steel pin, the latter lies in a metal bearing, and has upon it the capstan head and clamp. The capstan head has a boss upon the inner side, which keeps it clear of the rivets of the carriage, and holes in it for the iron-pointed lever by which it is turned; when thus moved it turns the spindle, as it has feathers on it, which enter slots in the latter, and the spindle by its pinion moves the arc. The clamp screws upon the spindle outside the capstan head, so that when tightened upon the latter it clamps the pinion. The thread of the spindle in the right bracket is left-handed, and of that in the left bracket right-handed, so that both the clamps are tightened by turning to the rear.

The capstan heads are interchangeable for either side of the carriage, the pinions with their spindles are not, nor are the elevating arcs. The arcs and pinions are marked with the nature of gun to which they belong, and the word "top" is stamped upon the upper end of each of the former.

Fittings. A metal trunnion plate, *g*, Fig. 42, is fixed in each trunnion hole by countersunk screws, and a capsquare secured over it by two feathered keys which are chained to the brackets. The capsquares are interchangeable from one side to the other, and also from one carriage to another of the same nature, though for convenience they are marked with the number of the carriage to which they are particularly fitted.

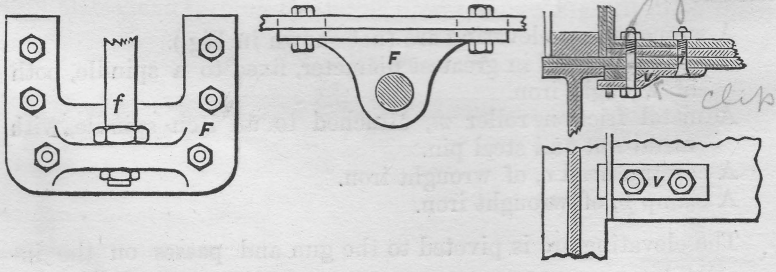
§ 4840. For future manufacture the loops of the capsquare keys will be made flush with the rivet heads, so as to clear the rope mantlets on recoil, when the carriage is mounted behind an iron shield.

A metal bouche, *x*, Fig. 42, is fitted in the hole in each bracket for the breeching rope used in the sea service.

A front and rear eye bolt for tackle is bolted to each bracket, a stud for a preventor rope to the bottom plate and a buffer block of elm to the front transom, also a loop for the priming wires is attached to the left bracket.

If the carriage is fitted for the hydraulic buffer, the fitments are simply a bracket, F, Fig. 45, bolted to the under side of the

Fig. 45.



bottom plate in front, through an oval hole in which the end of the piston rod *f*, passes for attachment, and two clip plates V, which are also bolted underneath the bottom plate. The clip plates project one on each side through a slot in the front of the guide plate, and hold the carriage during recoil to the platform, thus preventing the piston rod being bent.

If the carriage is fitted for the Elswick compressor, the fitments are as follows:—

Two joints or brackets *o*, *o*, Fig. 46, in which the rocking levers are pivoted, bolted beneath the bottom plate, one at either side of the opening in it.

Two brackets *d*, *d*, one for the support of each shaft, bolted on the bottom plate by the same bolts that secure the rocking lever joints.

Metal bearings, one in each bracket for the shafts.

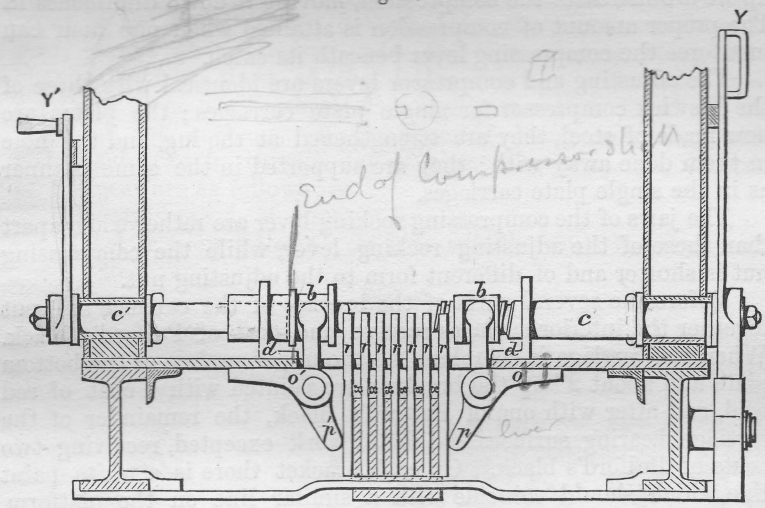
An arc on each bracket for the levers of the shafts to work on.

A bracket with elastic pad and plate over it, bolted to the right bracket of the carriage, to act as stop to the lever on that side.

The parts of the compressor are as follows:—

Compressor. E.O.C. for double-plate carriages.

Fig. 46.




Compressing shaft *c*, with collar, nut, metal collar, and solid key.

Adjusting shaft *c'*, with collar, nut, metal collar, and solid key.

Compressing rocking lever *p*, with pin and split key.

Adjusting rocking lever *p'*, with pin and split key.

Compressing lever Y, of steel.

Adjusting lever Y', of steel, with key and chain.

Compressing nut *b*, of metal.

Adjusting nut *b'*, of metal.

Compressor plates *r*, *r*, *r*, seven in number, the two outer ones thicker than the remainder.

Supporting bars with two screws, and two stops with screws, for the compressor plates.

The compressing shaft passes from the right bracket of the carriage through the nut of the right-hand rocking lever and into the nut of the left-hand lever; it has cut upon it a left and a right-handed screw thread, the former to work the right-hand lever, and the latter to work the left-hand. As therefore the compressing lever is thrown down and the shaft turned, the nuts move from each other, and compression is put on by the lower ends of the rocking levers moving towards each other. When the compressing lever is thrown up, the nuts travel towards each other, and compression is taken off.

To admit of adjusting the left rocking lever to any position, according to the amount of compression required, and yet at the same time not to interfere with the motion of the adjusting nut on turning the compressing shaft, there are long slots in the adjusting shaft which feathers in the nut enter. By this means, though turning the adjusting lever will place the nut in a new position on the compressing shaft, yet the nut is free to move in or out as the latter shaft is turned. Moving the adjusting lever up its arc increases the compression, moving it down diminishes it. The proper amount of compression is attained when one man can just force the compressing lever beneath its catch.

2069. The adjusting and compressor levers are identical with those of the Elswick compressor for single plate carriages; the plates are now made of steel, they are strengthened at the lug, and the hole in them done away with; they are supported in the same manner as in the single plate carriages.

The jaws of the compressing rocking lever are rather wider apart than those of the adjusting rocking lever, while the compressing nut is shorter and of different form to the adjusting nut.

**Painting the carriage.** Before the several parts of the bracket of the carriage are put together the interior surfaces receive one coat of Pulford's black. When the carriage is complete the the upper surface of the bottom plate and about 2″ up the brackets are painted with a coat of red lead, and after with one of Pulford's black, the remainder of the carriage, bearing surfaces and metal work excepted, receiving two coats of Pulford's black. On each bracket there is a white paint line which should coincide with a similar line on the platform, when the carriage is fully run up.

**Marking.** A metal plate, with the nature, mark, register number, and date of manufacture engraved on it, is attached to the outside of the left bracket.

## 9″ R.M.L. of 12 Tons Carriage. Mark I.

**9″ R.M.L. of 12 tons carriage. Mark I. R.O.D. photo-lithograph, 132 and 132A. Construction.** As already stated, this carriage is similar in construction to the 7″; the plates of the bracket are ½″ and the width of the frame 4″, making a total thickness of bracket of 5″. The thickness of

the bottom plate is $\frac{7}{8}$″, and the diameter of the axles of the front rollers, 2″. Before the adoption of running-back gear for the 9″ carriage, the eccentric axles (4″ in diameter) of the rear rollers were formed and connected as in the 7″ carriage, and a projecting socket or bracket was fitted to the rear end of each bracket of the carriage to take the bearing and admit of the use of roller handspikes on emergency. Since the adoption of running-back gear, the eccentric axles and connecting bar are formed in one piece, termed the "eccentric shaft." The shaft is supported at the centre by a metal bracket, which is bolted to and projects from the bottom plate, and serves as the point of attachment of a double block for running-back tackle. This bracket is in two parts, connected by a bolt (with round head).

The stop plates and sockets for the iron-pointed levers are similar to those on the 7″ carriage.

Fittings.

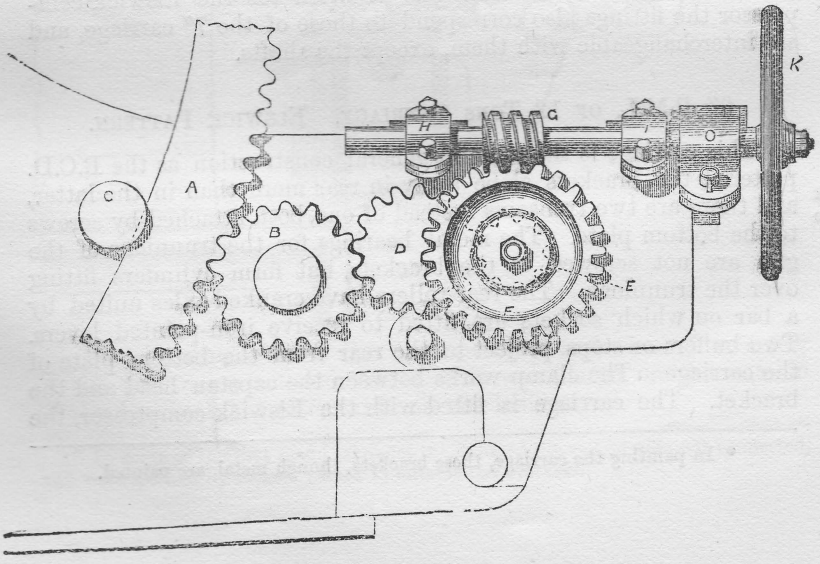
The shell of the block for the running-back tackle is of iron, and has a tee-shaped shank to enter a corresponding recess in the end of the bracket bearing of the eccentric shaft. When pushed home into the recess and given a quarter turn, the block is fixed. The sheaves of the block are metal, and take 3″ rope, they are held by a bolt secured by a pin, one end of the bolt forming a stud for the attachment of the standing end of the fall.

On many of the 9″ carriages issued the elevating arrangement is the same as that described for the 7″, the parts of the gear, except the elevating arcs and the pinions, being interchangeable with those of the latter carriage. The later made carriages have worm wheel elevating gear. It is fitted on both sides of the carriage, an arrangement being made by which either side can be thrown out of gear. On each side, the parts of the gear are as follows :—

Elevating arc A, of wrought iron.

Metal friction roller C, on iron spindle, with metal nut and steel pin.

Fig. 47.



Pinion for arc B, 7·91″ in diameter on spindle, both of wrought iron, with iron collar, metal nut, and steel pin.

Intermediate pinion D, 6·9″ in diameter on spindle, both of iron, with collar, &c., as previous.

Metal worm wheel F, 9″ in diameter, and pinion of iron E, 4·3″ in diameter on iron spindle, with two iron collars, metal nut, steel keep pin, and iron hexagonal nut.

Worm shaft G, of iron, 22¾″ long and 2″ in diameter, with metal hand wheel K, iron collar, and nut.

The spindles rest, as usual, in metal bearings in the side of the carriage: the arc passes, as in the capstan head elevating gear, between the friction roller and the arc pinion on the inside of the bracket, the intermediate pinion gears in this pinion, and the pinion on the spindle of the worm wheel with the intermediate pinion, so that by turning the worm wheel the arc is moved. The wheel is worked by the worm shaft, which is held by caps H, I, secured by screws, in two* metal brackets bolted to the side of the carriage. On the rear metal bracket a clutch O, is hinged, secured by a steel pin and retained by a turn-buckle: to throw the endless screw out of gear with the worm wheel the clutch is thrown back and the shaft turned and drawn to the rear until the collar on it which at first was to the front of the clutch, comes to the rear of it, when the latter is replaced and holds the shaft as desired.

The friction roller and its spindle are interchangeable with the same parts of the capstan head gear. The arcs and arc pinions are marked with nature of the gun, and the upper ends of the former "top." The worm wheels and the shafts are right and left as to thread, and are marked "Right" or "Left," the first-named going upon the right, the last upon the left bracket. The direction in which the shafts should be turned for elevation or depression is marked upon the carriage.

If the carriage is fitted for the hydraulic buffer the fittings are as in the 7″; the clips are longer, but the bracket is interchangeable with that of the 7″ carriage. If fitted for the Elswick compressor the fittings also correspond to those of the 7″ carriage, and are interchangeable with them, except the shafts.

## 9″ R.M.L. of 12 Tons Carriage. Elswick Pattern.

9″ R.M.L. of 12 tons carriage, Elswick pattern. (See L. of C., § 1584, for illustration.)

This carriage is the same in general construction as the R.C.D. pattern: the brackets slope away in rear more than in the latter, and there are two transoms instead of one, both attached by screws to the bottom plate. The metal bearings for the trunnions of the gun are not screwed to the brackets, but form cylinders fitting over the trunnions. The rear rollers have cranked axles united by a bar on which sockets are fitted to receive iron-pointed levers. Two buffers or stops project to the rear from the bottom plate of the carriage. The clamp works between the capstan head and the bracket. The carriage is fitted with the Elswick compressor, the

* In painting the carriage, these brackets, though metal, are painted.

parts of which are not interchangeable with the parts of the same compressor on the service carriages: the compressing lever is placed upon the left and the adjusting lever on the right side. These carriages are brought up to service pattern in their fittings as opportunity offers.

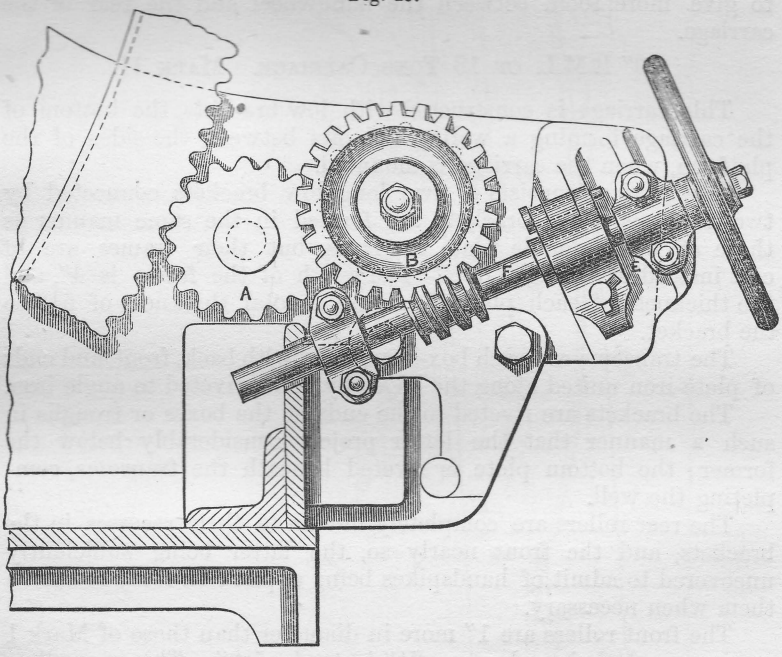
## 10″ R.M.L. of 18 Tons Carriage. Mark I.

10″ R.M.L. of 18 tons carriage. Mark I. (See R.C.D., photo-lithographs, 133 and 133A.)

This carriage differs in construction from the 9″ in having a second transom instead of knee stays to support the brackets in rear, and a second stay or packing piece between the sides of each bracket frame at the position of that transom. The frame of the bracket is 4″ wide, the plates each $\frac{5}{8}$″ thick, making a total thickness of $5\frac{1}{4}$″ and the bottom plate $\frac{7}{8}$″. There is no angular packing piece under the front transom, and no angle stay across the bottom plate.

The rear rollers are worked by an eccentric shaft* (as in the 9″ carriage), $2\frac{1}{2}$″ in diameter; the axles are 4″. The sockets for the iron-pointed levers and the block for the fall of the running back gear are interchangeable with those of the 9″, but not the metal supporting bracket; the latter has its parts connected by a bolt with a square instead of a boss head. The axles of the front rollers are 2″ in diameter.

Fig. 48.




The elevating gear is the "worm wheel and worm;" on a few of the first manufactured carriages it was placed on the outside of the brackets, but afterwards on the inside.

* In some of the first made carriages the axles of the rollers were not connected, and were worked by sockets (Mark I) outside the brackets.

In the latter case the parts on each side are as in the 9″ carriage, but without an intermediate pinion with spindle ; viz.:—

Elevating arc.

Friction roller on spindle, with nut and pin.

Pinion A 7·91″ in diameter, on spindle, with collar, nut, and pin.

Worm wheel B, 9″ in diameter, and pinion 7·91″ in diameter, on spindle, with two collars, one metal nut, one hexagonal nut, and a keep pin.

Worm shaft F, with handwheel, collar, and nut.

In the second pattern gear, namely, that fitted on the inside of the brackets, the friction roller, worm wheel, and hand wheel are interchangeable with the same parts of the 9″ gear, and the arcs, arc pinions, shafts and worm wheels are marked as in the latter, In the first pattern gear there is no second pinion, and the parts, except the friction rollers, are not interchangeable with those of the second pattern; the worm-shaft is 1·5″ in diameter instead of 2″, and the clutch is placed on the front instead of on the rear bracket supporting the shaft. In the second pattern the worm shaft is $25\frac{5}{16}$″ long.

A metal guide for the front of the elevating arc has now been substituted for the friction roller, and the worm wheel has been fitted with a friction cone. The worm shaft is lengthened so as to give more room between the handwheel and the rear of the carriage.

### 10″ R.M.L. of 18 Tons Carriage. Mark II.

§ 3823. Plate XXX.

This carriage is constructed with low brackets, the bottom of the carriage forming a well, which fits between the sides of the platform, when the carriage is mounted.

The carriage consists of two long low brackets connected by two transoms. The brackets are formed in the same manner as those of other double plate carriages, but their frames are of cast instead of wrought iron. The width of the frame is 4″, and the thickness of each plate $\frac{3}{4}$″, giving a total thickness of $5\frac{1}{2}$″ to the bracket.

The transoms are each box-shaped, *i.e.*, with back, front, and ends of plate-iron united along the edges by being riveted to angle iron.

L. of C., § 2791.

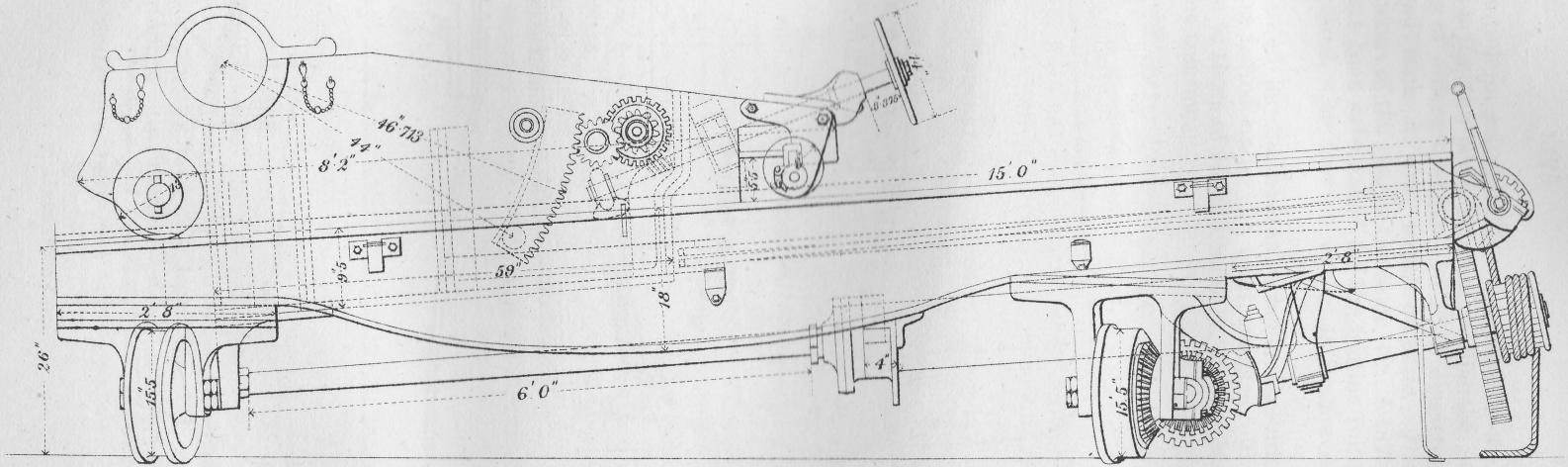
The brackets are riveted to the ends of the boxes or troughs in such a manner that the latter project considerably below the former; the bottom plate is riveted beneath the transoms, completing the well.

The rear rollers are completely hidden in their recesses in the brackets, and the front nearly so, the latter being sufficiently uncovered to admit of handspikes being applied in front to scotch them when necessary.

The front rollers are 1″ more in diameter than those of Mark I carriage, and their axles are $2\frac{1}{2}$″ instead of 2″. The rear rollers are the same as in Mark I carriage, and worked in the same manner by an eccentric shaft secured by drop plates, but not supported by a centre bearing. The block of the running back tackle is attached to the hind transom when used.

The elevating gear is the same as in Mark I carriage, but the

# 10 In 18 TON CASEMATE LOW CARRIAGE AND HIGH PLATFORM.




To face page 174.

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DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

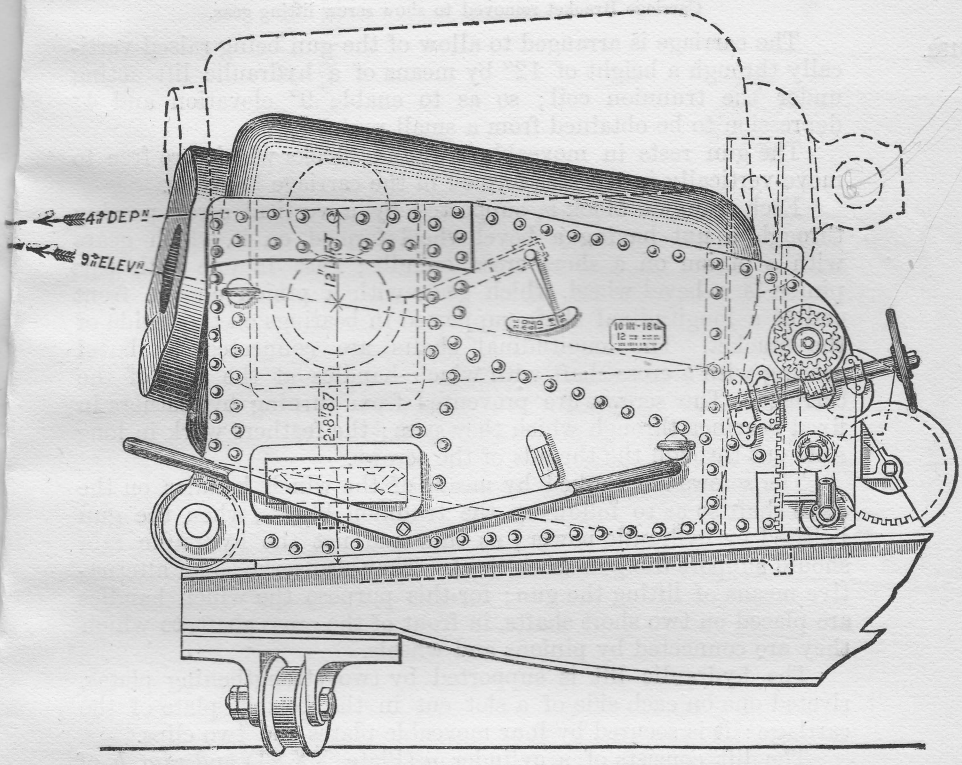
shafts and arcs are not interchangeable with those of the latter carriage, the arcs having the pivot holes in a different position, and the shafts being of different length and 2″ in diameter. The latter are supported each in two metal brackets. The pitch diameter of both pinions of the gear is the same, viz., 5·187″.

Metal guides have been substituted for the friction rollers, and the worm wheels fitted with friction cones, as in the Mark I carriages.

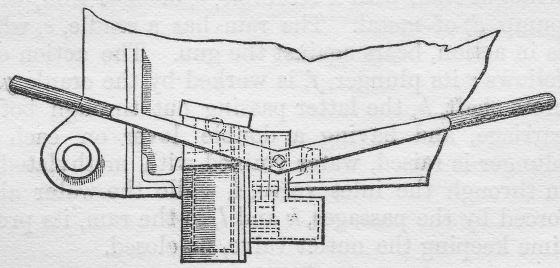
The carriage is fitted for the hydraulic buffer, the bracket for the piston rod being bolted under the front transom. The clips are of different form to those of Mark I carriage, and are bolted to the front of the front transom.

10″ Small Port Carriage.

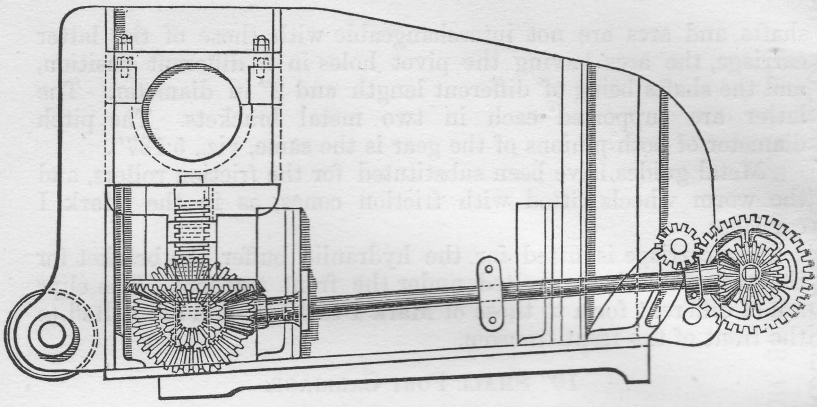
Fig. 49.—Scale ½-inch = 1 foot.




Side Elevation.



Hydraulic Lift.



SIDE ELEVATION.
Carriage Bracket removed to show screw lifting gear.

§ 3182. The carriage is arranged to allow of the gun being raised vertically through a height of 12″ by means of a hydraulic lift acting under the trunnion coil; so as to enable 9° elevation and 4° depression to be obtained from a small port.

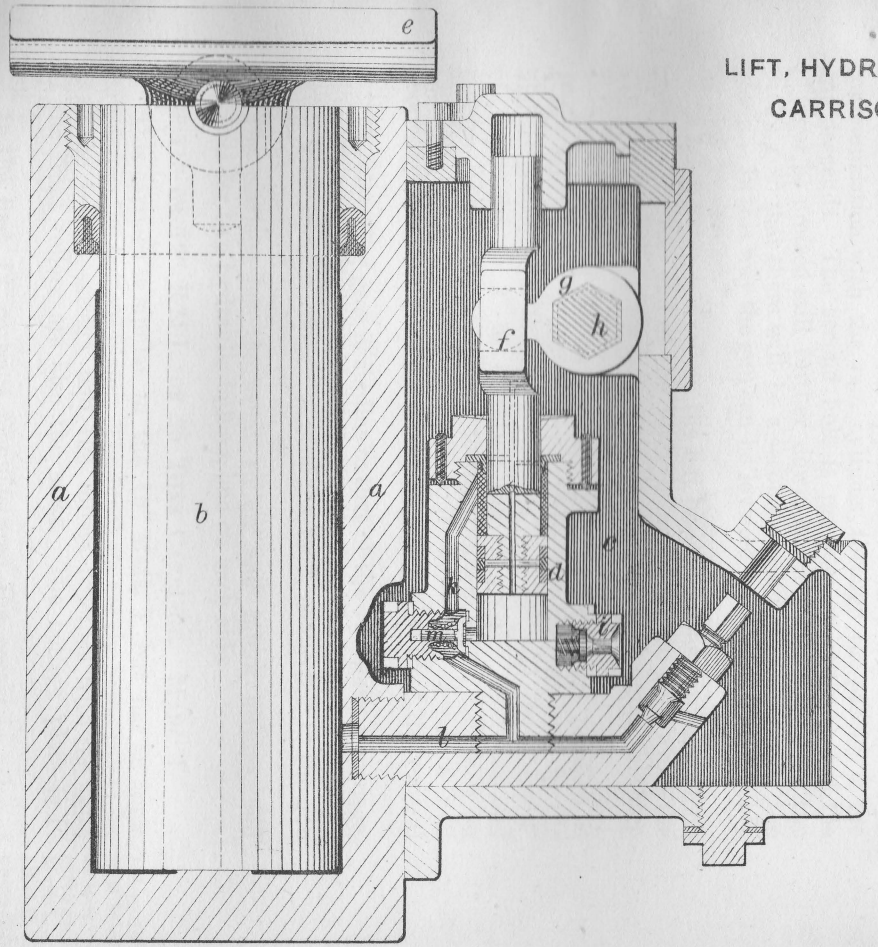
The gun rests in moveable trunnion blocks which are free to move vertically in recesses formed in the carriage brackets.

Each trunnion block is supported by a vertical screw passing through a nut having a bevel wheel formed on it, which gears with a pinion on a short cross spindle; cast in one with this pinion is a bevel wheel, which gears with a pinion on the front end of a longitudinal shaft, supported in bearings on the inside of the bracket. The longitudinal shafts are connected by bevel gearing with a cross shaft with winch handles at the rear of the carriage. The screws are prevented from turning by feathers in fixed bearings through which they pass; the feathers work in long slots cut through the threads of the screws.

The screws are worked by means of the winch handles on the cross shaft so as to follow up the trunnion blocks, when the gun is lifted by hydraulic power; as they and not the hydraulic ram should support the gun when fired. They also serve as an alternative means of lifting the gun; for this purpose the winch handles are placed on two short shafts, in front of the cross shaft, to which they are connected by pinions and wheels.

The hydraulic lift is supported by two strengthening plates, riveted one on each side of a slot cut in the bottom plate of the carriage: it is secured by four moveable plates and two clips.

The lift consists of a cylinder, *a* (Plate XXXI) and ram, *b*, of wrought iron, with a reservoir, *c*, of cast iron, which contains the pump, *d*, of metal. The ram has a cradle, *e*, which, when the lift is in action, bears against the gun. The action of the pump is as follows: its plunger, *f*, is worked by the crank, *g*, which fits on the cross shaft, *h*, the latter passing out through both brackets of the carriage, and having a double lever on each end. When the plunger is raised, water (mixed with methylated spirit) is drawn in through the inlet valve, *i*, while the water already above it is forced by the passages, *k* and *l*, to the ram, its pressure at the same time keeping the outlet valve, *m*, closed.




## LIFT, HYDRAULIC, CARRIAGE, WROUGHT-IRON, CARRISON, SMALL PORT, R.M.L. 10-IN.

**NOTE,** *The pump is adjusted to be at right angles to its position shewn.*

*To face page 176.*

DANGERFIELD. LITH. 22 BEDFORD ST. COVENT GARDEN

When the plunger descends, the pressure on the water under it closes the inlet valve, opens the outlet valve, and sends a flow by the passage, *l*, to the ram, and also by *k* to the upper part of the pump, above the piston.

The pump has an inside lowering arrangement. This consists of a central channel in the plunger communicating with the reservoir above the pump, and from this two very small side holes, one somewhat lower than the other, run out though the plunger. These are so placed that in the ordinary working of the pump they do not come below the leather packing in the top of the pump; but when the plunger is pressed down further than usual, by the lever handles, the lower one of them will come below the packing, and then the water can pass through it and up through the plunger into the reservoir, and as the upper part of the pump is always in communication with the ram cylinder, through the passage *k*, the gun descends. The second hole is provided in order that if the plunger be pressed still further down, it also shall come below the packing, so that there will be a second stream of water out of the pump. In this way the gun can be lowered either slowly or quickly as may be desired.*

A hinged stop is fixed on the left bracket of the carriage, which prevents the rear end of the lever being raised too high while the gun is being lifted; when it is required to lower the gun, this stop is folded in.

The height of the axis of the gun in the lowest position is 4′ 7½″, when from 2° to 9° of elevation can be obtained; in the highest position the height of the axis is 5′ 7½″, and then from 4° of depression to 2° of elevation can be given. An index and pointer (the latter connected to the trunnion block) are fitted on the left bracket of the carriage, and show the elevation and depression that can be given to the gun at any point of the vertical lift.

The elevating gear is similar to that of the 10″ Mark I carriage, but is fitted on the outsides of the brackets. The worm wheels are fitted with friction cones. A straight rack, connected to the gun by a link, is used instead of an arc.

The carriage has the usual rollers and minor fittings, and brackets for two hydraulic buffers, one on each side.

### 11″ or 12″ R.M.L. of 25 Tons Carriage. Mark I.

11″ or 12″ R.M.L. of 25 tons carriage. Mark I. (R C.D. photo-lithograph, 138A.)

This carriage is similar to the 10″ Mark I, but has an angle stay across the bottom plate. The brackets are the same thickness as in the latter carriage, and the rollers together with the axles of the front rollers are also the same. The bottom plate is 1″ thick.

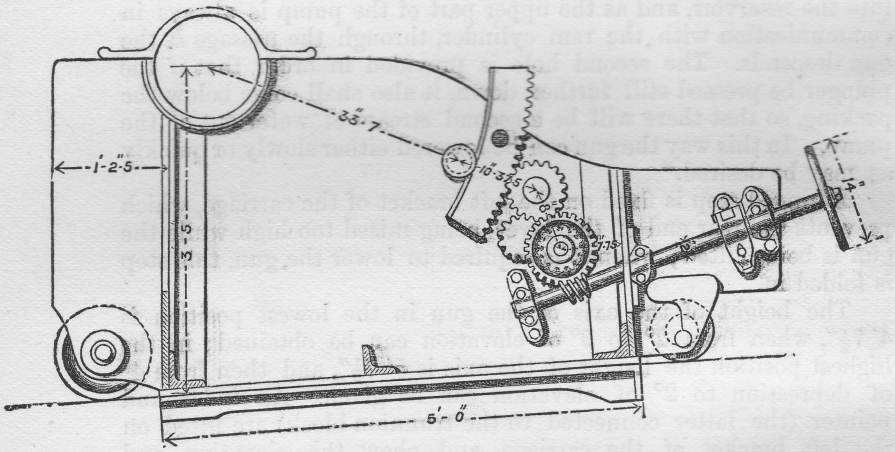
In the first 12″ carriage manufactured the eccentric axles of the rear rollers were made as in the 7″ carriage, and connected in the same manner by a bar. Such carriages were fitted with the capstan head elevating gear, the parts of which, except the arcs

* The pump and reservoir are shown in the plate as altered from external to internal release valves for existing carriages.

and their pinions, were interchangeable with the parts of the gear in the lower natures. Again, these carriages had the Elswick compressor, but with nine instead of seven plates, except the shafts all the parts being interchangeable with the same compressor in the 7″ or 9″.

In the later carriages the rear rollers have an eccentric shaft 2″ in diameter, and a bracket fitted with a treble block for the fall of the running-back tackle. Their elevating arrangement is the worm wheel and worm similar to the 9″, that is, with an intermediate pinion. The latter and the worm wheel pinion are each 5·9″ in diameter, and the worm shaft is 2″ in diameter and 45⅜″

Fig. 50.




long. The parts are not interchangeable with those of the 9″ nor, except the arc pinions, with those of the 10″.

The friction rollers have been replaced by metal guides, and the worm wheels fitted with friction cones, as in the 10″ carriages, and the worm wheels increased in size for gain of power; the worm shaft is also lengthened, as in the 10″ carriage, Mark I. The fitments for the hydraulic buffer are identical with those of the 10″ carriage.

### 12″ R.M.L. of 35 Tons Carriage. Mark I.

12″ R.M.L. of 35 tons carriage. Mark I. L. of C., § 3085.

This carriage is similar to that for the 38-ton gun, but has not been fitted with a tension buffer.

### Carriage R.M.L. 12·5″, Casemate or Dwarf 6′ Recoil. Mark II.

§ 3084.

Mark I carriage was constructed for a compression buffer, and when fitted with a buffer in tension the nomenclature is altered to Mark II. New carriages fitted with buffers in tension are also Mark II.

§ 4098.

The carriage (Mark II) is of double plate construction, the brackets being formed by two plates of wrought-iron riveted to a frame of cast-iron. They are connected by three transoms, two at the front, and one at the rear, and are strengthened by a pair of knee stays. The transoms and stays extending below the brackets

form a well to the carriage, which is completed by the bottom plate and by plates at the sides. The bottom plate does not extend to the rear transom. Its rear edge is strengthened by angle iron.

On the front transom a block of wood is attached to serve as a buffer.

Carriages for axial-vented guns have the rear transom lowered at the centre, and its upper edge strengthened by angle iron, to allow of the shutter being opened at extreme elevation.

The carriage and casemate platform are intended to fire over a 3′ 2″ genouillére the height of the axis of the gun above the top surface of the racer being 4′ 11½″.

The carriage allows of 10° elevation, and the elevating arc is graduated from 10° elevation to 5° depression, except for certain guns in elevated batteries, for which the arcs are graduated to 7° depression.

The parts of the carriage are:—

Elevating gear.
Nipping gear.
Hydraulic buffer.
Preventor gear.
Compressor stop plates.
Rear roller jack.
Capsquares.
Two metal front rollers with axles.
Two metal rear rollers with eccentric shaft.
Clip plates.
Rear step.

Elevating gear.

This is spur wheel gear, and consists of a train of wheels and pinions on the right bracket of the carriage worked by a hand wheel on the outside of the bracket. The elevating arc is rigidly attached to the gun, and is clamped by a bow cramp with screw with lever handle. The arc is graduated, and by means of a pointer fixed on the bracket of the clamp, readings of two minutes can be obtained.

The gear consists of the following parts:—

An arc of steel, 17 teeth.
Spindle, pinion, 3rd motion, of steel, 10 teeth, 5″ diameter with three feathers, wrought iron collar, and steel pin.
Spur wheel, 3rd motion, of wrought-iron, 37 teeth, 12·0483″ diameter.
Spindle pinion, 2nd motion, of steel, 10 teeth, 3·2563″ diameter, with wrought-iron washer, wrought-iron collar, and steel pin.
Spur wheel, 2nd motion, of wrought-iron, 37 teeth, 12·0483″ diameter, with three steel feathers.
Spindle pinion, 1st motion, of steel, 10 teeth, 3·2565″ diameter, with wrought-iron collar and nut.
Hand wheel of wrought-iron, 2′ diameter, with wrought-iron handle and nut.
Brake cramp with screw, handle and split key, all of wrought iron.

Bracket for cramp, with two jamming blocks, five 1″ tap bolts and a cramp supporting screw, all of wrought-iron, also with steel pointer and wrought-iron screw for elevating arc.

Guard, metal, for spur wheel, with four ·75″ tap bolts.

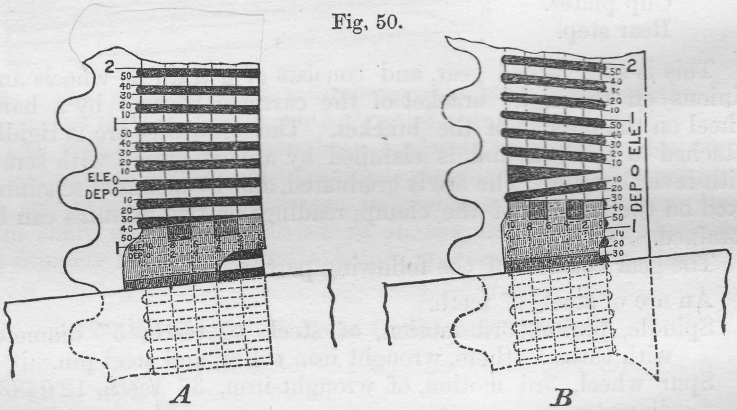
The arc is rigidly attached to the gun on the right side; it gears with the 3rd motion pinion. The 2nd and 3rd motion spindles rest in metal bushes in the right bracket of the carriage. The 1st motion spindle is forged on each side of its pinion. One end rests in a metal bush in the carriage, and the other in a bearing formed in the guard. The end working in the guard has a square shank on which the hand wheel fits and is secured by the collar and nut.

The cramp bracket is attached by the tap bolts to the top of the right bracket of the carriage, in rear. It is formed with two lugs between which the arc passes. In each lug there is a rectangular hole in which a jamming block works. The cramp, which is in the form of a bow, pivots on a supporting screw attached to the rear of the bracket. The inner end of the cramp is plain and bears against the inner jamming block. The screw passes through the outer end of the clamp and bears against the outer jamming block. To clamp the gear the screw is turned by the handle and the jamming blocks are pressed against the sides of the arc.

§§ 3256, 3571, 3830.

The outside of the arc is graduated. The graduations Fig. 50, consist of alternate black and white spaces, each of which is numbered and represents an angle of 10 minutes, the graduations being inclined upwards for elevation and downwards for

Fig. 50.




*A* *B*

depression. The spaces are subdivided across the arc, so that by means of a pointer, fixed on the bracket of the clamp, readings of two minutes can be obtained. In Mark II arc and pointer (B), the upper edge of the pointer is radial with the axis of the trunnions, and coincides with the zero of the arc, when the gun is horizontal. In Mark I arc and pointer (A), the graduations on the arc were radial from the centre of the trunnions, and the edge of the pointer lay diagonally across them. There were separate zero lines and sets of readings on the arc and pointer, for elevation and depression.

Nipping gear.

Is used to connect the carriage with the running back chains on the platform. A sprocket plate on each side is suspended through a slot in the bottom plate of the carriage by a link from a lifting lever.

These levers are keyed on a cross shaft supported in bearings on the bottom plate. The left hand lever is connected by a link with an eccentric worked by a lever handle outside the bracket of the carriage. A counterweight on the right lifting lever, keeps the sprocket plates raised and out of gear with the chains, when they are not forced down by the lever handle. The running back chains pass through brackets beneath the carriage, which hold them up to the sprocket plates when the latter are forced down.

The following are the parts of the gear :—

Two sprocket plates, W.I.
Two guide plates, W.I., each with four ·75″ tap bolts.
Two guide brackets, W.I., each with four 1″ hexagonal head bolts, and two 1″ countersunk head bolts with nuts.
Four links, W.I., with four W.I. connecting pins, each with a collar and galvanized split key.
Two lifting levers, W.I.
An eccentric link, W.I., bushed with metal, with keep screw, connecting pin, collar and split key.
Counterweight, cast-iron, with ·75″ bolt and nut.
Eccentric spindle, W.I., with metal bush and two ·625″ tap bolts, and metal bracket with two ·875″ bolts.
Cross shaft, W.I., with two keys.
Two brackets, metal, for cross shaft, each with a metal cap and six ·875″ tap bolts.
Nipping lever, W.I., with feather and pin.
Retaining pawl, W.I., with W.I. stud and nut, bracket and two ·5″ tap bolts.

The guide brackets are bolted to the bottom plate, on each side of the slots, the guides are bolted by tap bolts to the brackets; the guide with its bracket on each side forms a rectangular box, through which the running back chain passes.

The cross shaft rests in its bearings, fixed by tap bolts on the bottom plate of the carriage, on each end of this shaft a lifting lever is secured by a key. The rear end of each lever is connected with the sprocket plate beneath it by a pair of links with pins. The plates hang through the slots in the bottom plate, over the chains.

The counterweight is bolted to the front end of the right hand lifting lever. The eccentric link is connected with the front end of the left hand lever by a pin secured by a collar and split key.

The link consists of a circular band forged with a double lug, which forms the joint with the lever. It has a metal bush in which the eccentric works, and in which it is kept in position by a keep screw, which is screwed into the band, and which works in a groove in the eccentric. The eccentric is forged solid with its spindle, the latter works in two metal bearings, one in the left bracket of the

carriage, and the other attached to the second transom. On the outer end of the spindle the nipping lever is keyed, and secured by a tapered pin. The retaining pawl is pivoted on the stud, which is screwed into the carriage side, and is secured by the nut. One end of the pawl is hooked, and the other end formed to act as a counter-weight, which bears on an iron bracket fixed to the side of the carriage, and keeps the hooked end of the pawl in such a position that it engages a stud riveted to the nipping lever: until the pawl is released the sprocket plates are thus retained out of gear with the running back chains.

**Hydraulic buffer.**

The buffer consists of the following parts :—

A cylinder, which up to 1885 has been made of wrought-iron, lapwelded, but which for future manufacture will be of steel; external diameter 9″, internal diameter from 7·566″ to 7·57″, length 6′ 6″.

A wrought-iron rear cap with eyebolt, chain and filling plug.

A front bracket cap of metal, with leather band, cup leather, inner and outer metal glands, steel run-off valve, and iron set screw. The bracket is secured to the carriage by two 1·125″ tap bolts and eight 1·125″ bolts and nuts.

Piston rod W.I. 3·5″ diameter with piston 7·56″ diameter, with keep screw, also two nuts with taper steel pins. Length of rod 8′ 0.25″. The packing of the piston rod is similar to that for siege buffers p. 83.

There are four holes in the piston of the sizes given in the table :—

| | 160 lbs. charge, P. 2. | 180 lbs. charge, P. 2. | 210 lbs. Prism. |
|---|---|---|---|
| Casemate, 6 ft. recoil .. .. .. | — | ·44 | ·43 |
| Dwarf C and D .. .. .. .. | ·44 | — | — |
| Casemate, 7 ft. recoil .. .. .. | — | ·45 | ·45 |

The cylinder of the buffer is secured to the carriage underneath the bottom plate, in front, by the front cap, and in rear by a wrought-iron band. The working contents of the buffers are $9\frac{3}{4}$ gallons.

**Compressor stop plates.**

The compressor stop plates are two plates suspended under the carriage, which becoming jammed between the plates of the compressor stop on the platform, prevent the carriage running up after recoil.

The parts of the gear are as follows :—

Two compressor plates of W.I.

Two rear brackets of angle iron, one right and one left hand, each with three 1″ bolts.

Two front brackets of W.I., one right, with two 1″ countersunk bolts, and one left, with three 1″ bolts.

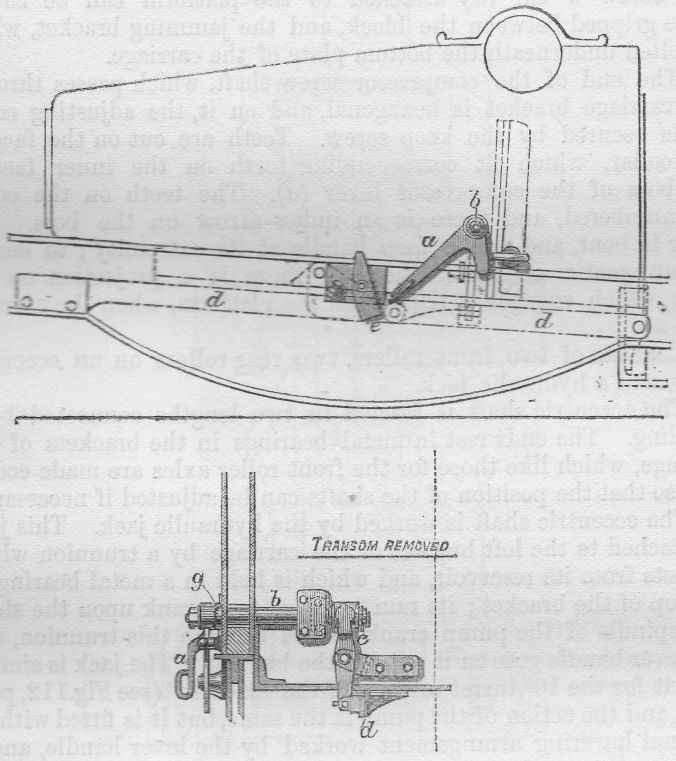
Two pins of W.I. each with a split pin.

The rear brackets are bolted on top of the bottom plate of the

carriage on the right hand side in rear of the nipping gear. The rear ends of the compressor plates are supported on pins passing through the brackets and secured by split keys. The compressor plates are formed by plates ·75″ thick, bent to a right angle, the two parts being unequal in length. The short part of each plate passes through a slot in the bottom plate of the carriage and is secured to the bracket as above-mentioned; the longer part lies along the under side of the bottom plate of the carriage, and is attached to the front brackets, which are bolted underneath the bottom plate.

This gear is for the purpose of keeping the carriage under control in running up. The parts of the gear are as follows:— Preventor gear. Fig. 51. § 4252.

Fig. 51.




Compressor screw (*b*) 2·5″ diameter, with adjusting collar and set screw; collar-nut, and loop head split key, all of W.I.
Compressor lever W.I. (*a*).
Rocking lever W.I. (*c*).
Compressor nut, metal.
Bracket, W.I., for rocking lever with wrought-iron pin, loop head, split key, and two $1\frac{1}{16}$″ bolts.
Flanged metal bush, with two ·625″ tap bolts.
Bracket, metal, for screw compressor, with metal cap, two ·75″ tap bolts, and two ·875″ bolts.

Jamming block, metal, with W.I. pin.
Jamming bracket, metal, with two 1″ bolts.

The compressor screw (*b*) is formed on a shaft passing through the flanged bush, which is fixed in the right bracket of the carriage, and supported in the metal bracket, which is bolted to the second transom. The screw works in the compressor nut, which is carried in the forked end of the rocking lever (*c*). This lever pivots on a pin passing through the second transom and secured by a split key. The lower end of the lever passes through a slot in the bottom plate of the carriage, and has the metal jamming block pivoted to it by a plain pin, which is secured in position by a keep screw in the lever. By working the screw a bar (*d*) attached to the platform can be caused to be gripped between the block, and the jamming bracket, which is bolted underneath the bottom plate of the carriage.

The end of the compressor screw shaft, which passes through the carriage bracket is hexagonal, and on it, the adjusting collar (*g*) is secured by the keep screw. Teeth are cut on the face of the collar, which fit corresponding teeth on the inner face of the boss of the compressor lever (*a*). The teeth on the collar are numbered, and there is an index arrow on the boss. The lever is bent, and has a loop handle at its extremity; to ensure the automatic action of the gear there is a projection on the lever, which engages a tripper on the platform, when the carriage runs up.

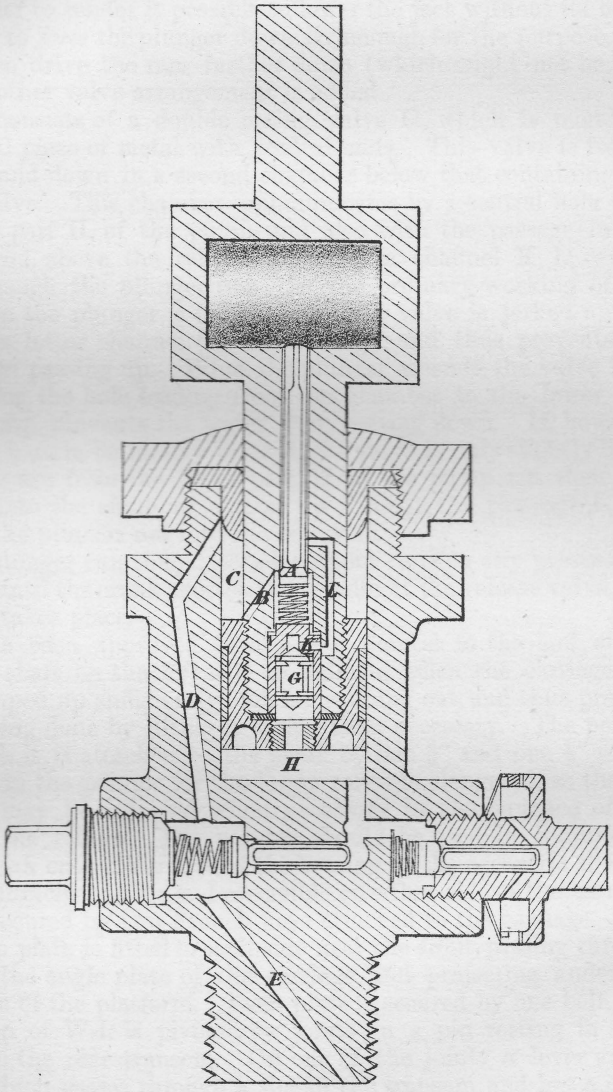
Running up gear.

Consists of two front rollers, two rear rollers on an eccentric shaft, and a hydraulic jack.

The eccentric shaft is formed in two lengths connected by a coupling. The ends rest in metal bearings in the brackets of the carriage, which like those for the front roller axles are made eccentric, so that the position of the shafts can be adjusted if necessary

The eccentric shaft is worked by the hydraulic jack. This jack is attached to the left bracket of the carriage by a trunnion which projects from its reservoir, and which is held in a metal bearing on the top of the bracket; its ram is keyed to a crank upon the shaft. The spindle of the pump crank passes through this trunnion, and the lever handle goes on it outside the bracket. The jack is similar to that for the 10″ turret carriage of the "Hecate" (see Fig.112, page 373), and the action of the pump is the same, but it is fitted with an internal lowering arrangement worked by the lever handle, and a separate screw plug is not required. This arrangement is as follows:—There is a chamber in the plunger (see enlarged sketch of pump, Plate XXXII), which communicates by a small side hole B with the upper part of the pump C; from this chamber there also runs a passage up through the plunger rod. The bottom of this passage is closed by a valve A in the chamber, pressed upwards by a spiral spring; this valve has a long spindle, which runs up through the passage, and projects slightly at the top of the plunger rod, and into a groove in the crank, which works the plunger. This groove is so formed that the valve spindle is not touched during the

# PUMP FOR JACK, HYDRAULIC, REAR ROLLER, CARRIAGE, IRON, WROUGHT, GARRISON SLIDING, RIFLED. M.L. 12 INCH 35 TON AND 12·5 INCH 38 TON.




DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12452.

ordinary working of the lever handle; but if the latter be pressed far down, the surface of the crank presses the valve spindle downwards and opens the valve. A free passage is thus made for the water to return from the ram cylinder up through the passages E and D, into the upper part of the pump C; then through the side hole into the chamber, and from that into the reservoir by the passage in the plunger rod.

In order to render it possible to lower the jack without its being necessary to *force* the plunger down far enough for the purpose, and in doing so drive the ram further down (which might not be possible), another valve arrangement is added.

This consists of a double acting valve G, which is merely a cylindrical piece of metal with conical ends. This valve is free to move up and down in a second chamber below that containing the release valve. This chamber communicates by a central hole with the lower part H, of the pump, and also with the passage in the plunger rod above the release valve, by a channel K, L, carried round through the plunger rod. In the ordinary working of the jack, when the plunger is forced down, the valve is jerked up and closes this latter channel (as in the Fig.), and thus prevents the water from passing up. When the plunger ascends, the valve falls, and, closing the hole leading from the chamber to the lower part of the pump, prevents the water from passing down. If, however, the lever handle be merely pressed, the valve is only slightly lifted, and the water from the lower part, H, of the pump can then pass round it into the chamber, and so up through the passsage L, and through the plunger rod into the reservoir.

The plunger can thus descend, without causing any pressure on the ram, until the crank presses the spindle of the release valve, and lowering takes place.

§ 4549. R.C.D. Instruction. Plate CXXXIV.

It has been approved to attach a pointer to the end of the eccentric shaft on the left side to indicate when the carriage has been pumped up sufficiently high for running out, and thus prevent injury being done by lifting it higher than necessary. The pointer is of steel, it is attached to the shaft by one $\frac{3}{8}''$ and one $\frac{1}{2}''$ screw. The hole in the pointer for the larger screw is elongated, so that its position may be adjusted when necessary in consequence of the wear of the rollers. The pointer should be used in conjunction with a mark cut on the face of the bearing of the eccentric shaft.

Capsquares.

Are interchangeable and reversible on either side of the carriage. Each is secured by two French keys attached to the carriage.

Clip plates.

A clip plate is fitted to each side near the front, passing through a slot in the angle plate of the carriage, and projecting under the top flange of the platform. Each plate is secured by one bolt.

Rear step.

A step of W.I. is pivoted by joints on a pin resting in studs riveted to the rear transom. On one of the joints a lever arm is forged, which passes through a slot in the transom, and has a counterweight secured on it by a bolt and nut.

§ 5248.

A similar step with counterpoise is also fitted on the right side of the rear transom.

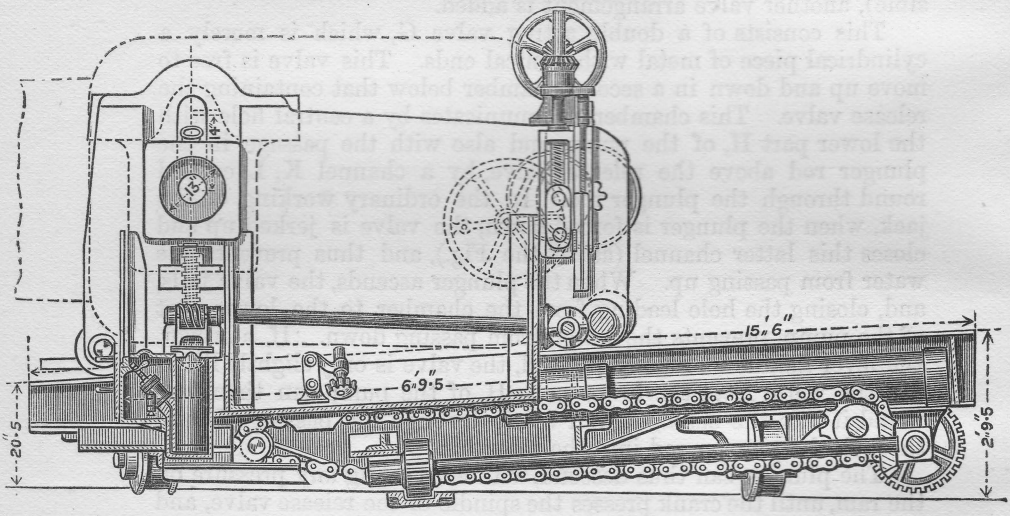
## Carriage R.M.L. 12·5″ Casemate, 7′ Recoil, Mark II.

§§ 3184, 4167.

The carriage differs from Mark II, 6′ recoil, in the position of the front buffer cap, the length of the buffer, and the size of the piston holes. The hydraulic buffer contains $11\frac{1}{4}$ gallons when full and the carriage run up to the front stops. From this amount one quart will be withdrawn to give the working quantity. The piston has four holes 0·45″ diameter.

## Carriage R.M.L. 12·5″ Small Port, 6′ recoil, Mark I.

Fig. 52.




§ 3836.

This carriage is designed like that for the 10″ to enable 7° elevation and 4° depression to be obtained from a small port. The arrangement of the carriage is generally similar to that for the 10″.

The total vertical movement of the trunnions is 14″.

The carriage is double plate, the frame being of cast-iron. The brackets are connected by three transoms and a bottom plate, which are arched downwards. To prevent seizure, a metal plate is attached to the under surface of each bracket. In each bracket there is a recess in which a trunnion block, carrying the trunnions of the gun, can slide vertically when the gun is raised or lowered by the hydraulic lift. Each bracket is strengthened on the exterior at the recess by a plate and arched forging riveted to the frame. There is a slot in the plate through which a stud, fixed on the trunnions of the gun projects.

The front transom and bottom plate are cut away to admit the lift, which is supported in grooves formed in two plates connecting the 1st and 2nd transoms. The lift is covered in front by a plate, secured to the front of the front transom by six pins and keys.

The parts of the carriage are:—

Hydraulic lift.
Following up gear.
Elevating gear.
Nipping gear.
Preventor gear.
Running up gear.
Clip plates.

Hydraulic lift.

The hydraulic lift, Plate XXXIII, consists of a wrought-iron ram A, and a metal cylinder B, the latter being formed in one casting with a cistern C, which contains the pump D.

A wrought-iron cradle E, is jointed to the top of the ram by a steel screw pin, F, and when the lift is in action takes a bearing under the gun. A cup leather H, is secured on the bottom of the ram by a metal nut K. Projections cast on the outside of the lift fit in grooves in plates on the bottom plate of the carriage between the front transoms.

The pump is double acting, taking in fluid at the up stroke of the plunger; at the down stroke half the fluid is forced under the ram, the other half passing by a channel to the upper side of the piston of the plunger, whence in the following up stroke, it is forced under the ram. The release is effected through a longitudinal channel in the plunger, which is in communication with the space above the plunger piston. The channel is closed at its upper end by a release valve L, which is kept on its seat by the pressure. The valve is formed with a stem, which, during lifting, works in a groove cut in a metal plunger guide M, fixed in the cistern. When it is required to release, the plunger is drawn out beyond the usual stroke, when the valve will be forced in by the inclined end of the groove.

The spindle N and crank O of the pump are of steel. A wrought iron socket spindle fits on each end of the pump spindle, and passes through a metal bush in the carriage bracket on its own side. Double ended levers fit on the outer ends of these spindles. The length of the up stroke of the plunger is regulated by a jointed stop bracket on the carriage, which is folded back to clear the lever when it is required to lower the ram.

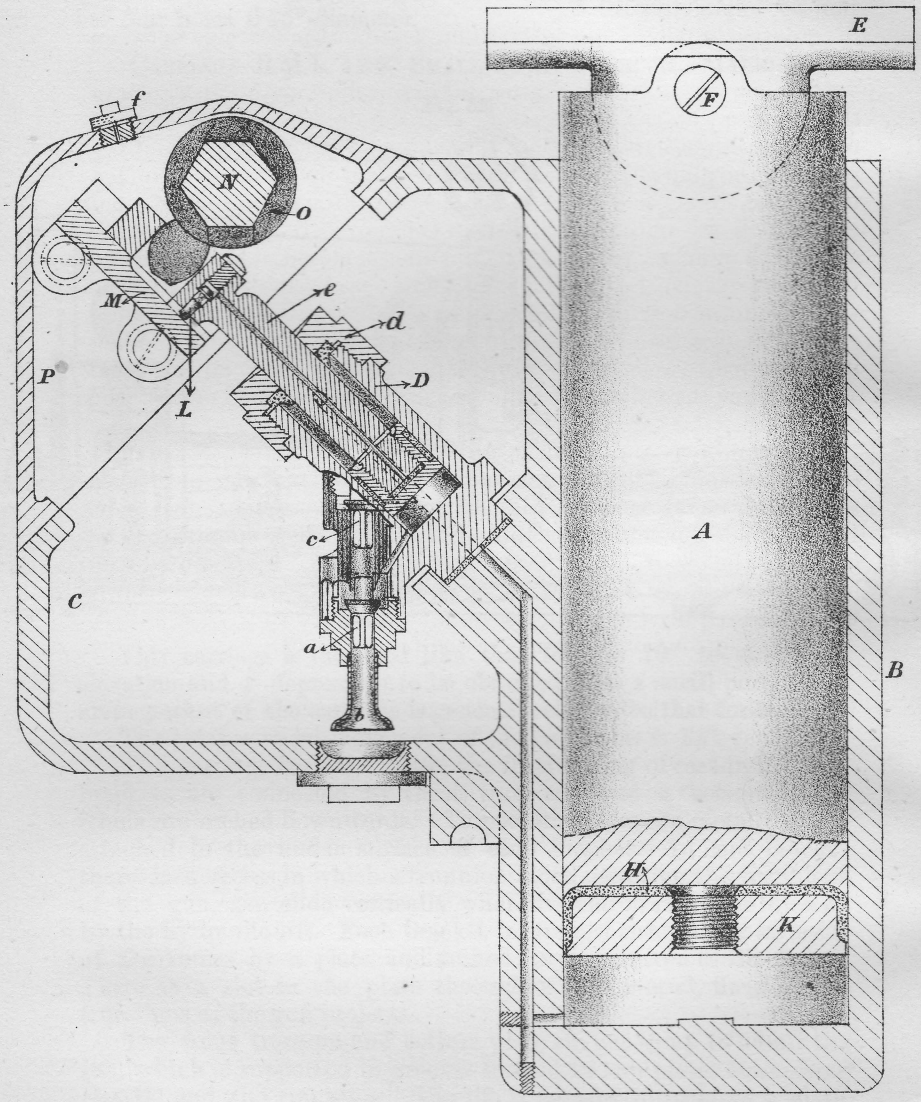
The following are the parts of the pump:—

Cylinder D.
Metal suction valve and seating (*a*), leather collar and metal suction pipe (*b*).
Metal delivery valve (*c*) and closing plug.
Metal cap for pump (*d*) with cup leather.
Metal plunger (*e*) with metal head, leather thong and washer, metal release valve, closing plug, and leather collar.
Steel crank aud spindle.
Metal guide with four P.B. cheese head screws.
Metal cover for cistern P, with two screwed glands, two leather collars for ditto, metal air hole plug (*f*), and leather collar; and six ·625″ bolts.

Following-up gear.

Is similar to that for the 10″ S.P. carriage but is not intended for use in raising the gun. The height of the trunnions of the gun can be read by means of a metal pointer on each trunnion stud, which works along a metal scale graduated in inches attached to the edge of the slot in the strengthening plate on the outside of the carriage bracket.

The position of the screws is shown by a pointer which works over an index plate on the outside of the left bracket, and which is connected with the left hand screw by a directing bar with a




DANGERFIELD, L.TH. 22, BEDFORD ST. COVENT GARDEN. 12452.

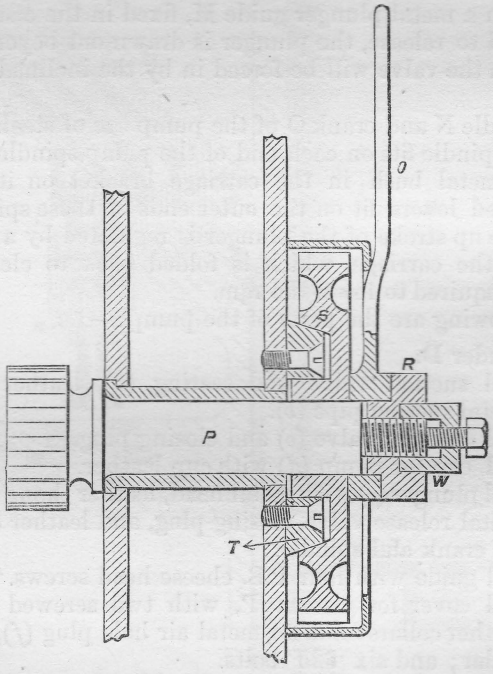
metal shoe. The bar is pivoted at one end to the top of the following up screw; the shoe, which is attached to the bar by screws, works in a wrought iron guide with a shank, which passes through the bracket of the carriage. The pointer fits on the end of the shank. As the screw moves, the inclination of the directing bar changes, and the guide with the pointer is caused to turn.

Elevating gear.

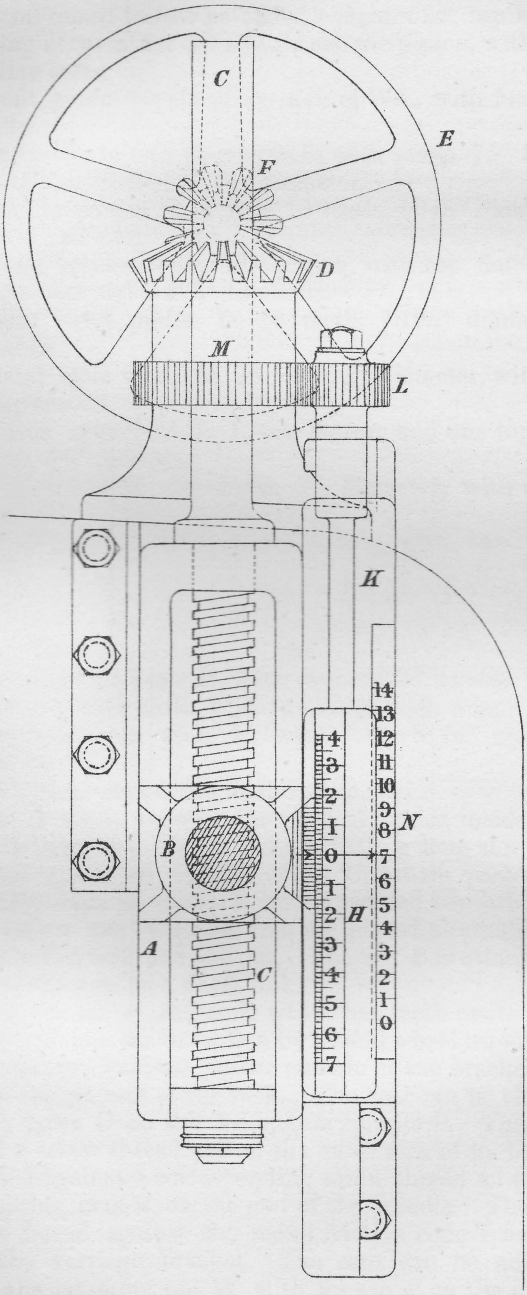
The following are the parts of the elevating gear:—Plate XXXIV, and Fig. 52A.

A steel elevating rack A, 10 teeth, with steel bearing for elevating screw, and four ·625″ cheese head steel set screws.
A steel elevating screw C, 2·5″ diameter, ·75″ pitch with W.I. collar ·75″ thick with set screw, two W.I. collars ·125″ thick, and two leather collars ·25″ thick.
A steel nut B, for screw elevating, with steel connecting link and steel pin 3″ diameter, with ·25″ taper pin for link.

Fig. 52A.




A steel spindle pinion, 3rd motion, P, 8 teeth, 5″ diameter, with W.I. jamming nut W, and ·75″ set screw.
A metal jamming cam R.
A W.I. jamming lever O.
A metal friction cone T, with six ·75″ conntersunk screws.
A W.I. spur wheel, 3rd motion, S. 47 teeth, 15·0054″ diameter, with two steel feathers.
A W.I. spur wheel, 2nd motion, 37 teeth, 12·0483″ diameter.
A steel spindle pinion 2nd motion 10 teeth, 3·1926″ diameter with two steel feathers, W.I. collar, and steel taper pin.




DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12455.

A steel spindle pinion, 1st motion, 10 teeth, 3·2563″ diameter with W.I. collar and nut.
A W.I. hand wheel, 24″ diameter, with handle and nut.
A metal guard in two parts, with eight ·625″ tap bolts.
Bearing of metal for 1st motion spindle pinion, with two ·75″ collar bolts.
A front guide for elevating rack of W.I., with four ·75″ tap bolts.
A rear guide in two pieces, W.I., with seven ·75″ tap bolts.
A metal handwheel E, 18″ diameter.
A spindle pinion F, of W.I. 10 teeth, 4·045″ diameter with collar and nut.
A metal bracket for spindle pinion, with cap, four ·625″ tap bolts, and eight ·875″ tap bolts.
A metal bevel pinion D, 18 teeth, 7·198″ diameter, with feather.
A metal spur wheel M, 56 teeth, 7″ diameter, with two ·5″ keep screws.
Two iron spur pinions L, one bottom and one top, each 28 teeth, 3·5″ diameter.
A W.I. screw K, for scale, 1″ diameter, with collar and nut.
An upper metal bracket for screw, with two ·625″ tap bolts.
A lower metal bracket for screw, with two ·375″ tap bolts.
A metal nut for screw in two parts, with two ·375″ cheese head screws.
A metal sliding scale H, with four ·1875″ screws.
A metal vernier scale, with two studs with nuts.
A wrought iron scale N, with four ·3125″ cheese head screws.
A W.I. plate supporting metal scale.

The rack A works between the vertical guides, inside the right bracket of the carriage. It is formed with a long slot, in which slides the nut B on the vertical screw C, which passes through bearings in the ends of the rack, and is secured beneath by a nut. Collars of leather and wrought iron are placed alternately on the screw, between the rack and the nut. The nut B is attached to the pivot piece on the gun by a short link.

For giving elevation, the rack which has teeth on its rear edge, is moved by a pinion, set in motion by a hand wheel through a train of spur wheels and pinions on the outside of the bracket, the nut and screw moving as part of the rack. The gear can be clamped by the jamming lever O on the 3rd motion spindle P. The lever has a portion of a screw thread cut on the outer face of its boss, which can be jammed against a corresponding screw thread on the face of a metal jamming cam R, on the end of the spindle. The wheel S can thus be forced against the metal friction cone T fixed to the outside of the carriage bracket. The cam can be adjusted as required by the jamming nut W, with set screw on the end of the spindle.

To suit the varying position of the trunnions, as the gun is

raised or lowered by the hydraulic lift, the nut B linked to the gun can be moved in the slot in the rack. For this purpose the screw is continued above the rack as a plain spindle, which passes through the bevel wheel D, placed above the carriage bracket, and worked by the handwheel E through a second bevel wheel F. The connection of the screw spindle with the bevel wheel is made by a long slot in the spindle and a feather in the wheel, so that the spindle can slip up or down the wheel as the rack is raised or lowered, but the spindle must always turn with the wheel. When the wheel is worked the nut is caused to slide up or down the slot in the rack.

The quadrant elevation of the gun can be read by means of a vernier scale on the nut, and a scale H in rear of it, which is graduated in degrees with intervals of 10 minutes, from 7° elevation to 4° depression. By the vernier on the nut the scale can be read to one minute.

To enable the position of the scale plate to be adjusted to suit the varying position of the trunnions of the gun, it is attached to a nut, which works on the vertical screw K, in rear of the rack. On the upper end of this screw is the spur pinion L, which gears with the spur wheel M, on the spindle of the screw C.

The pitch of the screw and teeth of the wheel are so regulated that when the upper handwheel is turned the nut and the scale rise or fall together.

At the rear of the scale plate is the W.I. scale N, graduated in inches from 1 to 14. This scale is read by an arrow head, which is on the rear edge of the scale plate, opposite the zero. When this arrow points to the same height on the inch scale, as the trunnion arrow head does on its index plate, the quadrant elevation or depression of the gun can be read by means of the vernier.

To prevent irregularity in the movement of the scales, the pinion L is made in two parts; the upper with a recess, the lower with a friction cone; the parts are adjusted by a nut on the end of the screw. The teeth of the upper part press against one side. those of the lower against the opposite side of the teeth of the spur wheel, so that play between wheel and pinion can be very much reduced.

The nut of the scale plate is also in two parts, kept in adjustment by two screws, to reduce play between the threads of the screw and nut.

**Nipping gear.** The nipping gear is generally similar to that described, p. 181. The lifting levers, from which the sprocket plates are suspended, are on separate cross shafts which are inclined downwards to suit the curved bottom plate, and are connected in the centre by segments of bevel wheels. There is no eccentric, the left hand cross shaft passes through the left bracket of the carriage, and the nipping lever is secured on its extremity. A lanyard for raising the nipping lever is attached to a loop at its end and passes over a sheave attached to the carriage.

**Preventor gear.** The preventor gear is generally similar to that described p. 183. The rocking lever pivots in bearings on the bottom plate, its

upper end is connected with the nut on the compressor screw by two W.I. links, one on each side.

Running up gear.

The running-up gear is similar to that described p. 184. The trunnion of the rear roller jack is held in a metal-bushed bearing near the top of the carriage bracket.

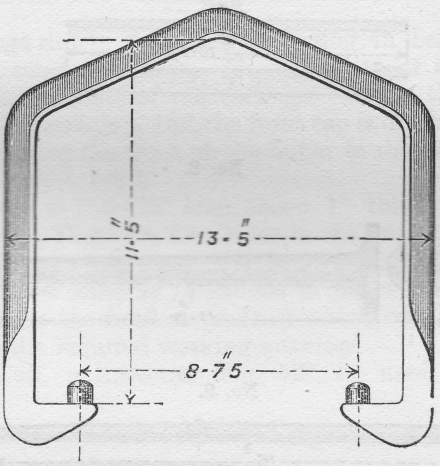
§ 4182.

The undermentioned special implements, Fig, 52B, are required with the carriage :—

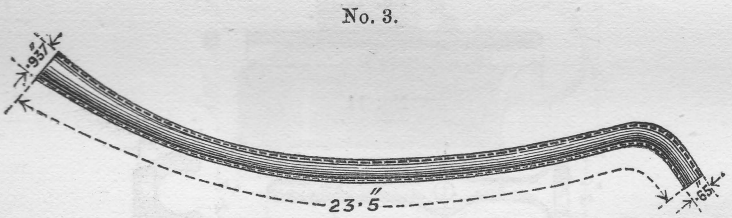
Bar, lifting pump, wood.
No. 2. Bracket, lifting pump, W.I.
„ 3. Pipe, filling, lift, copper.
„ 5. Spanner, cap pump, steel.
„ 6. „ cover, cistern and run-off plug, steel.

Fig. 52B.

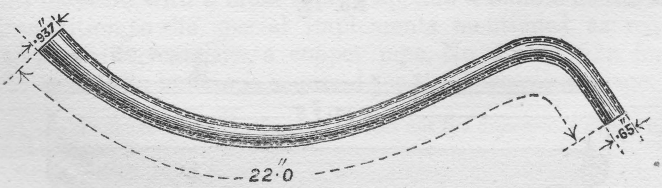
No. 2.



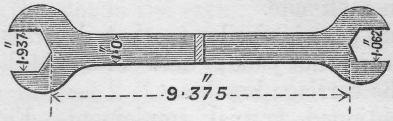

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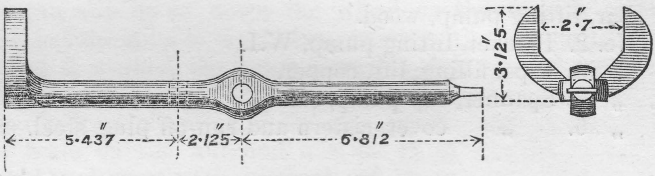

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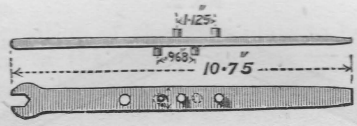
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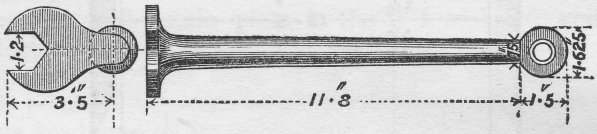

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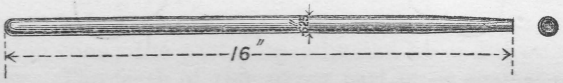

No. 7.



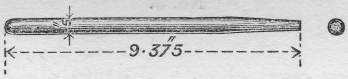

No. 8.



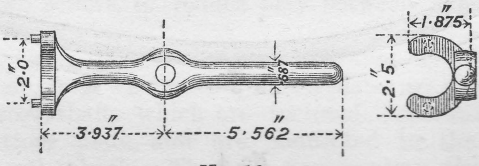

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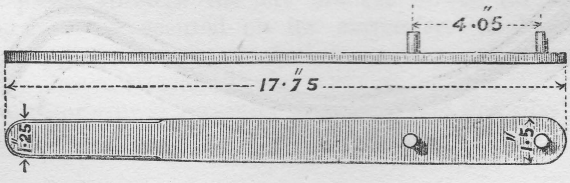

No. 10.




No. 11.




No. 12.



No. 7. Spanner, valve release, also filling-plug and pump plunger.
„ 8. „ valve, suction.
„ 9. Tommy, steel, large.
„ 10. „ steel, small.
„ 11. Wrench, ram leather, steel.
„ 12. „ spindle gland.

The wood bar is 10′ long and 4″ in diameter; it is intended with the bracket for removing the hydraulic lift.

The tommies, spanners, and wrenches, are for use in taking apart and putting together the hydraulic lift and its pump.

The copper pipe, 3, is required for filling the lift. It is used in conjunction with the service filling measure.

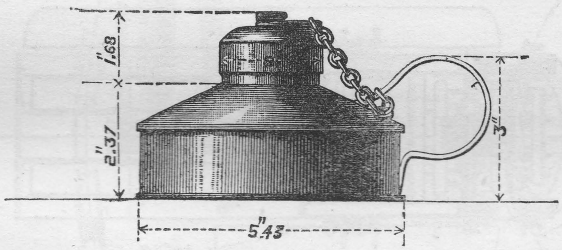
## Carriage 12·5″ R.M.L., Small Port, 7′ Recoil.

This carriage differs from the preceding in being fitted with two hydraulic tension buffers. The cylinders of the buffers are fixed to the bottom plate of the carriage. As in the case of the ordinary type of carriage p. 182, the front cap is of metal, and forms a bracket for securing the front of the buffer to the carriage, the rear being held by a W.I. band.

The cylinder is 7′ 3·125″ long, about 1″ thick, and 6·06 internal diameter. There are four holes in the piston ·5″ diameter. The buffers are connected near the front by a copper equalising pipe. Each buffer contains 7½ gallons of oil when full, with the carriage run up to the front stops, from which one quart must be drawn to give the required working quantity.

To draw off, a measure, Fig. 52c, is used, designated in vocabulary 1886, as measure, hydraulic buffer, draw-off, two pints, tin, naval, R.M.L. 12″ 35 tons turret, and 11″ Temeraire type. It is a tin measure with a brass screw cap, and a handle at the side. Measure, draw off. §4182.

Fig. 52c.*




In addition to the special implements mentioned as required for the preceding carriage, a copper pipe, No. 4, Fig. 52b, for filling the hydraulic buffers is required for the 7′ recoil carriage.

* The figure above shows the form only, and not the dimensions of the measure described in the text.

## CHAPTER V.—IRON MEDIUM CARRIAGES.

§ 4484. Sliding carriages, both wood and iron for medium guns have been placed in a numbered series. The wood carriages have already been mentioned p. 154.

§ 4533. All carriages of this description, issued in future, will have their distinguishing numbers marked on the inscription plates.

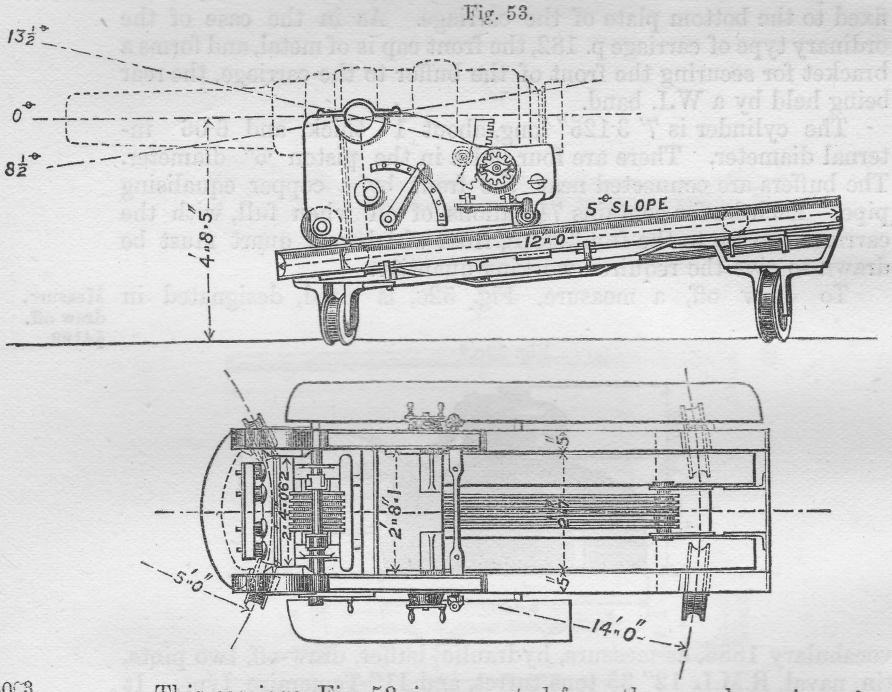
Carriages issued previous to the above order are marked with their distinguishing numbers directly under the inscription plates.

The following are the iron carriages in the service.

### Carriage, Medium, No. 1.

R.B.L. 7″ 82 cwt., for Platforms Nos. 1, 2 and 3.

Fig. 53.



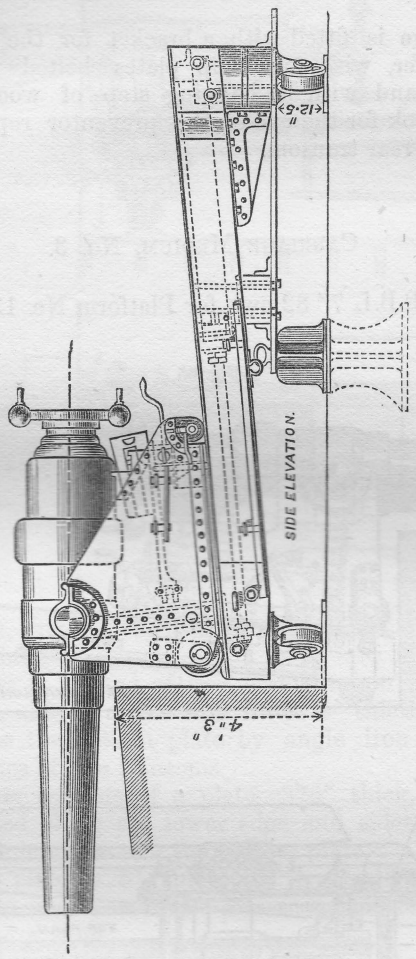

§ 4063. This carriage, Fig. 53, is converted from the naval carriage for the R.M.L. 7″ 6½ ton gun.

The conversion consists in reducing the width between the brackets and trunnion bearings; the compressor screw is adjusted to suit the reduced width, and a wood step for loading is added outside each bracket. The carriage will allow of 13½° elevation, and 8½° depression.

## Carriage, Medium, No. 2.

### R.B.L. 7″ 82 cwt. for Platforms Nos. 11 and 12.

Fig. 54.




§ 4210. The carriage, Fig. 54, consists of two single plate brackets of wrought iron connected by a bottom plate and two transoms. A forged trunnion plate is riveted on the outer side of each bracket round the trunnion hole to give sufficient bearing for the trunnion of the gun; a metal bearing plate is attached by screws in the trunnion hole, and an iron capsquare fitted over it.

The carriage is fitted with four metal rollers; the axles of the front rollers are supported in flanges, bolted to the sides of the carriage, in which they rest in metal bearings secured by screws. The axles of the rear rollers are eccentric, and are formed on an

eccentric shaft, which works in metal flanges bolted to the rear of the carriage. The ends of the shaft are fitted with sockets to take the iron-pointed levers. A stop-plate is riveted on the outside of each bracket in front of this shaft.

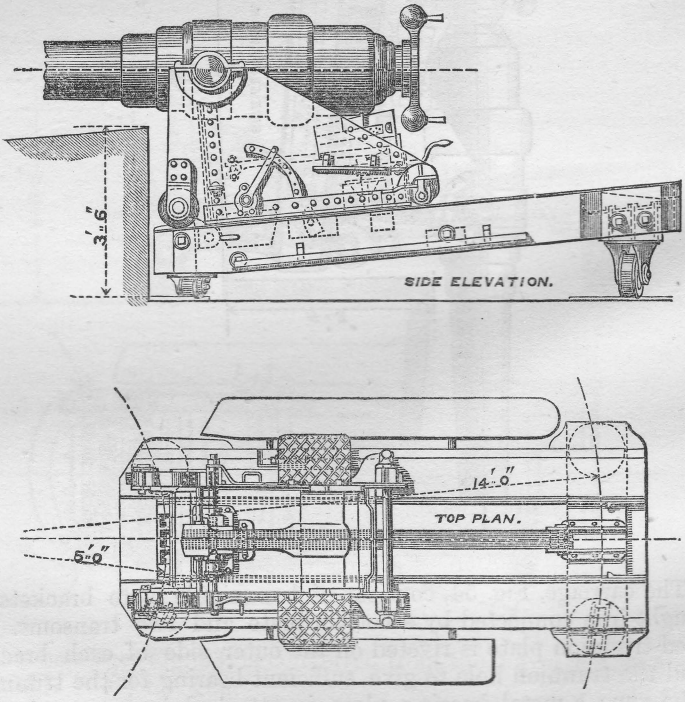
The elevating gear is similar to that for wood sliding carriages, and consists of a screw with ratchet head and lever, stool bed and coin.

The carriage is fitted with a bracket for the piston rod of a hydraulic buffer, with four clip plates bolted underneath the bottom plate, and with a hanging step of wood outside each bracket. A hook for the eye of the preventor rope is riveted to the rear of the rear transom.

## Carriage Medium, No. 3.

### R.B.L. 7″ 82 cwt. for Platform No. 13.

Fig. 55.

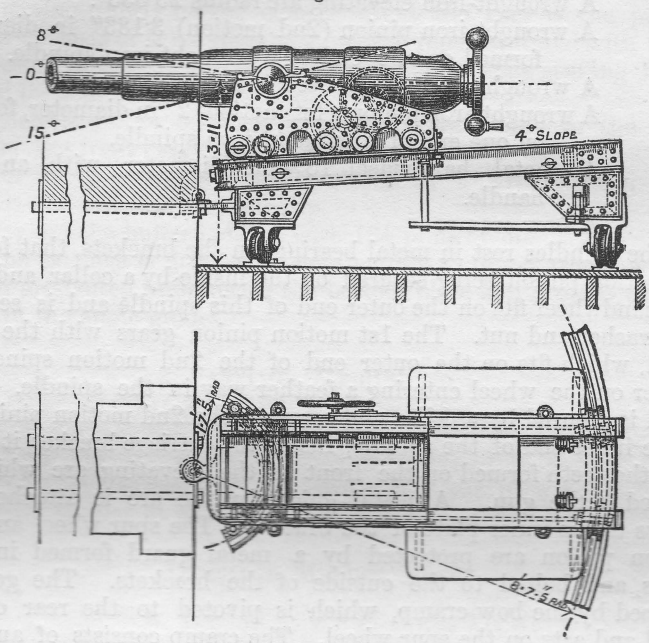



§ 4209. This carriage, Fig. 55, is similar to the preceding, but is fitted with the E.O.C. compressor (see p. 169) instead of for the hydraulic buffer.

## Carriage, Medium, No. 4.

### R.B.L. 40-pr. for Platform No. 4.

Fig. 56.




The carriage, Fig. 56, consists of two brackets, two transoms, and a bottom plate. § 4235.

Each bracket is formed of two wrought iron plates $\frac{3}{8}$″ thick, riveted on each side of a cast iron frame 3″ thick. The brackets are connected to the bottom plate by angle iron on the inside and by the frames of the transoms.

Each transom consists of a plate ·375″ thick, with an angle iron frame riveted along the lower edge and sides, by which it is connected to the brackets and the bottom plate.

The bottom plate is ·5″ thick. It has guides of angle iron riveted along its under surface. The rear ends of the guides are bent round to form stops.

The carriage is supported on ten steel rollers, metal bushed, which are permanently in action.

The diameter of the rollers is 6″.

The rollers run upon steel axles 1·759″ in diameter, which rest in eccentric iron bearings in the brackets, and are secured on the inside by nuts and steel pins. The bearings are each secured by two screws. The heads of these screws on the outside act as feathers in slots in the axle, and prevent their turning Eyebolts are formed on the ends of the front roller axles. Recesses are cut in the outer plates of the brackets to facilitate the removal of the rollers when it is required to clean them.

Fittings.

A screw clamp is bolted to the rear of each bracket to hold the carriage run back when required.

Elevating gear.

Elevating gear is fitted on the right bracket only and consists of—

A wrought-iron elevating arc radius 25·633″.
A wrought-iron pinion (2nd motion) 3·183″ in diameter formed on one end of a wrought-iron spindle.
A wrought-iron spur wheel 7·321″ in diameter.
A wrought-iron pinion, (1st motion) 2″ in diameter, formed on one end of a wrought-iron spindle.
A metal handwheel 18″ in diameter, with an iron handle.
A bow cramp.

The spindles rest in metal bearings in the brackets, that for the 1st motion pinion being secured on the inside by a collar and pin. The handwheel fits on the outer end of this spindle and is secured by a washer and nut. The 1st motion pinion gears with the spur wheel, which fits on the outer end of the 2nd motion spindle, a feather on the wheel entering a feather way in the spindle. The wheel is secured by a collar and screw. The 2nd motion pinion is on the inner end of the spindle, inside the carriage bracket, it gears with the teeth formed on the front of the elevating arc which is pivoted to the gun. A metal guide for the arc is attached by screws to the inner plate of the bracket. The spur wheel and 1st motion pinion are protected by a metal guard formed in two pieces, and bolted to the outside of the brackets. The gear is clamped by the bow cramp, which is pivoted to the rear of the guard and acts on the spur wheel. The cramp consists of an iron bow, with a screw spindle and lever handle, both of iron, friction pads of steel and a steel pivoting pin. An indicator plate, having arrows marked on it, showing the direction in which the handwheel must be turned for elevation and depression is attached to the guard.

Hydraulic buffer.

The carriage is fitted with a hydraulic buffer in tension.

The buffer cylinder is of wrought-iron 4·052″ internal diameter, 5″ external diameter, and 3′ 9·5″ long. It is closed iu rear by a wrought-iron cap screwed on. The front end of the cylinder is screwed into a metal cap, cast in one piece with a bracket, which is housed into the bottom plate of the carriage, and secured to it by six bolts. In rear the cylinder is supported by a wrought-iron band bolted to the bottom plate. A wrought-iron packing piece is fitted between the cylinder and the bottom plate at the position of the rear band. The piston and piston rod are of wrought-iron forged in one piece. The piston is 1·25″ in thickness and with three holes, each ·32″ in diameter. The piston rod is 2″ in diameter. It passes through the stuffing box in the metal cap, and its end passes through the platform girders and web plates. It is secured in front outside the web plates by a nut through which passes a steel pin; next the web plates on the inside there are two india-rubber rings each ·75″ thick, separated by a wrought-iron ring ·125″ thick, and secured by a wrought-iron nut.

The stuffing box is packed in the following manner:—A metal collar is placed in the inner end of the recess; over this collar is placed a U ring of leather; a metal ring is put in, which bears against a shoulder formed in the box, and when in its place presses the leather ring tightly on the collar. Next the ring is the packing which consists of three rings of 2″ cotton rope saturated with tallow put round the piston rod so as to break joint. The stuffing box is closed by a metal packing gland.

There is a draw-off cock, with steel screw plug in the lower part of the front cap.

For filling a short metal tube closed by a wrought-iron screw plug is screwed into the rear cap.

For use the buffer is filled with $13\frac{1}{2}$ pints of oil.

The carriage is fitted with holding down clips in front and rear, which are bolted underneath the bottom plate and project through slots in the angle guides.

### Carriage, Medium, No. 5.

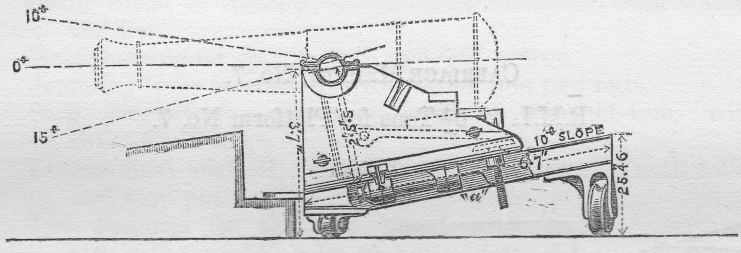
R.B.L. 20-pr. for Platform No. 5.

A drawing of this carriage has been sealed, to govern manufacture, but no carriage of this nature has yet been made. It is generally similar to No. 4 § 4211.

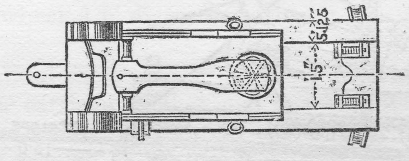
### Carriage, Medium, No. 6.

S.B., B.L. 32-pr. for Platform No. 6.

Fig. 57.




"*a*" side of platform removed to show buffer.



The carriage Fig. 57, consists of two brackets, a transom, and a bottom plate all of wrought-iron. The brackets are of single plate and are attached to the bottom plate by angle iron. Trunnion bearings are riveted to the brackets, and guide plates which are bent round to form stops, to the bottom plate. § 4039.

The carriage is not fitted with rollers but is intended to slide on the upper surface of the platform both in recoil and in running up. A lubricating groove is cut in the bottom plate on each side, to which channels, cut through the plate and angle irons, and closed by screw plugs, lead.

The carriage will allow of 10° elevation and 15° depression.

**Elevating gear.** The elevating gear consists of an elevating screw, stool bed and coin. The screw is fitted with a metal handwheel, it works in a metal nut attached by two bolts to the bottom plate, through which it passes. The stool bed pivots on a cross bar riveted between the brackets in rear of the front transom, it is secured by a galvanized pin with chain, attached to the front transom. Pieces of iron are riveted to the bracket plates in rear to serve as fulcra for handspikes in laying.

**Hydraulic buffer.** The carriage is fitted with a hydraulic buffer. The cylinder is 21·625″ long, 5″ external diameter, and about ½″ thick. It is closed at each end by a wrought-iron screw cap. The piston is of wrought-iron with four holes ·75″ diameter. The piston rod is of wrought-iron 2·254″ diameter. The total length of recoil allowed by the buffer is 20″. The packing of the piston rod is similar to that described (p. 83). Working contents of the buffer 6 pints. The buffer is secured to the carriage underneath the bottom plate by two wrought-iron bands, the front band secured by two and the rear by four bolts. A slot is cut in the bottom plate of the carriage to give access to the filling hole of the buffer.

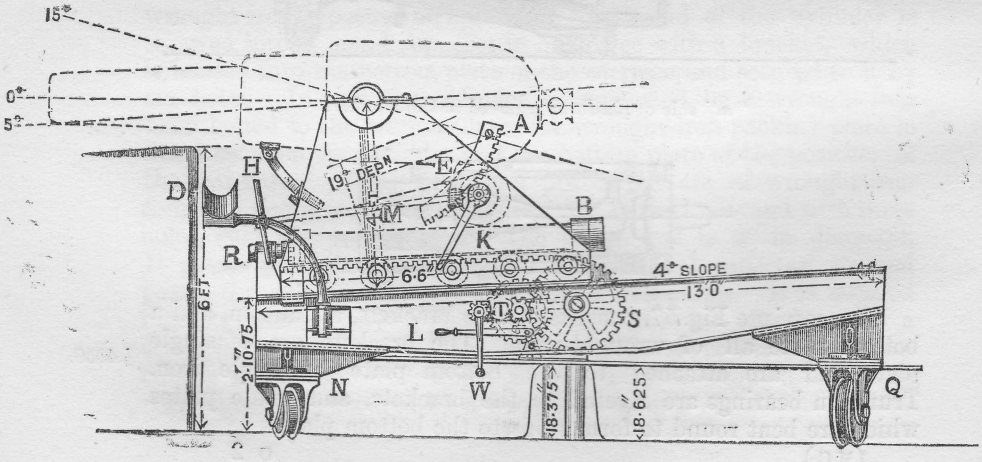
Four holding down clips are bolted underneath the bottom plate, two on each side.

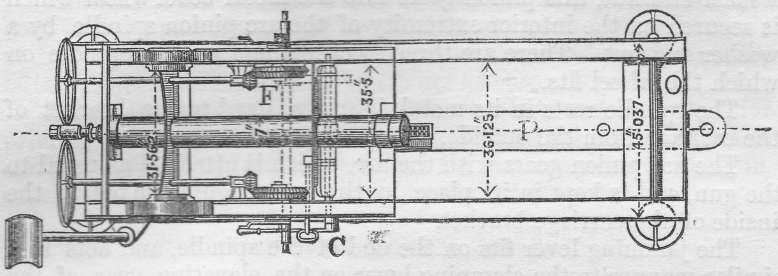
A metal clamp with iron screw to secure the carriage when run back for housing is fitted to the left bracket.

## Carriage Medium, No. 7.

### R.M.L. 7″ 6½ Tons for Platform No. 7.

Fig. 58.






The carriage, Fig. 58, is of the double plate construction. The brackets consists of wrought-iron plates, riveted on each side of a cast iron frame, they are connected by two transoms and a bottom plate; the plates of the brackets are prolonged below the bottom plate, and receive the bearings for the roller axles. A cast iron rack is bolted underneath the bottom plate. § 3986.

The rollers are of steel bushed with P.B. They are 8″ in diameter and 3·25″ in width. Rollers.

The roller axles are steel, 2″ in diameter. They rest in iron eccentric bearings, fixed in the plates of the carriage brackets. There are lubricating holes in the axles closed by screw plugs.

The elevating gear consists, on each side of the carriage, of the following parts:— Elevating gear.

Arc A of wrought-iron, 27 teeth, 2′ 9·75″ radius.
Metal guide for arc, E, with three ·75″ screws.
Arc pinion and spindle in one forging of wrought-iron, pinion has 13 teeth, diameter 5·2″, diameter of spindle 2·5″
Bevel wheel of metal F, 44 teeth, 14″ diameter, with washer and nut.
Metal bearing for spindle with two ·75″ screws.
Jamming lever of steel K, with washer and two nuts.
Stop bracket for jamming lever of wrought-iron, with two ·75″ screws.
Longitudinal shaft M, wrought-iron, 1·5″ diameter with collar and steel pin.
Two bearings for shaft of metal with metal capsquares, rear with four ·75″ bolts and two screws for the capsquare, front with two bolts and two screws.
Bevel pinion with washer and nut.
Metal handwheel, 18″ diameter with nut.

The longitudinal shaft rests in its bearings, which are fixed to the inside of the carriage bracket, and in which it is held by the metal capsquares, secured to the bearings each by two screws.

The collar is secured on the shaft in rear of the rear bearing by a steel pin.

The handwheel fits on the front end of the shaft, which is made square and is secured by a nut.

The bevel pinion is secured on the rear end of the shaft by a

washer and nut, this pinion gears into the metal bevel wheel which is secured on the interior extremity of the arc pinion spindle by a washer and nut. There are three steel feathers on the spindle on which the wheel fits.

The spindle rests in its metal bearings, fixed to the bracket of the carriage from the outside.

The arc pinion gears with the arc, which is attached as usual to the gun, and is kept in its place by the metal guide, fixed to the inside of the carriage bracket.

The jamming lever fits on the end of the spindle, and acts in a similar manner to the clamping lever on the elevating gear of the 12·5″ S.P. carriage (see p. 188). The lever is secured on the spindle by a washer and two nuts. The stop bracket prevents the lever releasing itself during recoil.

A metal inscription plate attached to the outside of the bracket under the lever, shows the direction it should be turned in order to clamp or release the gear.

To enable the quadrant elevation to be read from the front of the carriage, a metal arc is pivoted underneath the gun in front of the trunnions.

The free end of this arc passes through a slot in a cross plate fixed to the brackets of the carriage at the breast, and slides on a metal bracket bolted to the cross plate, which acts as a pointer.

The arc is graduated in degrees and quarter degrees from 30° elevation to 5° depression. It is also marked at 19° depression, the amount required for loading under cover. On each side of the pointer bracket, a metal indicator plate, marked with an arrow head, is attached by two screws. The arrow head indicates on the arc the quadrant elevation of the gun.

Metal inscription plates on the front cross-plate show the direction in which the handwheels should be turned for elevation or depression.

Hydraulic buffer.

The hydraulic buffer rests on the bottom plate of the carriage, and passes through holes made for it in the transoms. The buffer cylinder is wrought iron, closed at the rear end by a W.I. cap screwed on. The front end of the cylinder is screwed into a metal cap, formed with a flange, which is housed into and bolted to the bottom plate of the carriage. A set screw on the left side prevents the cylinder turning in the cap. In rear the cylinder rests on a W.I. packing plate, and is secured by a W.I. iron band, held by two bolts. There is a filling hole closed by a wrought iron screw plug in rear; a metal emptying cock also closed by a wrought iron screw plug, is screwed into the flange of the front cap, on the left side. The piston is wrought iron with four holes, ·6″ in diameter. It is screwed on the rear end of the piston rod, which is wrought iron, 2·5″ diameter, and 6′ 9·25″ long. The front end of the piston rod rests in a bracket on the front of the platform, and is secured by two nuts, which are screwed on the rod, in front and rear of the bracket. The front nut is secured by a taper steel pin which passes through the rod, and rests in a groove in the face of the nut.

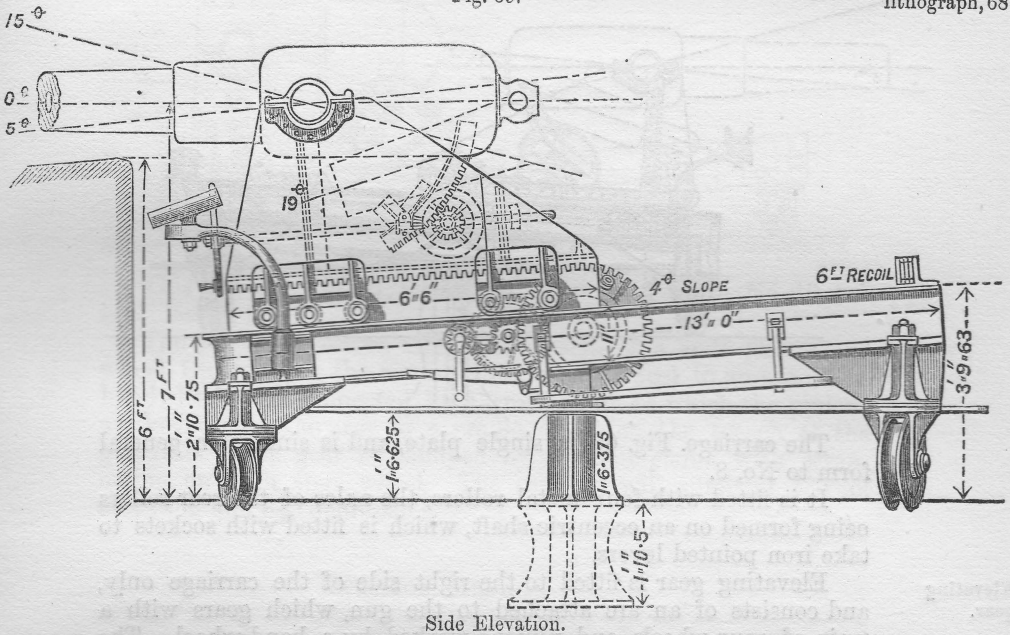
Holding down clips are bolted to each bracket of the carriages both in front and rear. The front clips are placed on the outside of the carriage bracket, the rear clips on the inside; and, on these latter, projections are formed which act as stops in recoil.

There are two eyebolts on each bracket, and a socket for priming irons attached by four screws on the left side. The carriage is fitted with metal bearings for the trunnions of the gun, capsquares and keys as usual. Minor fittings.

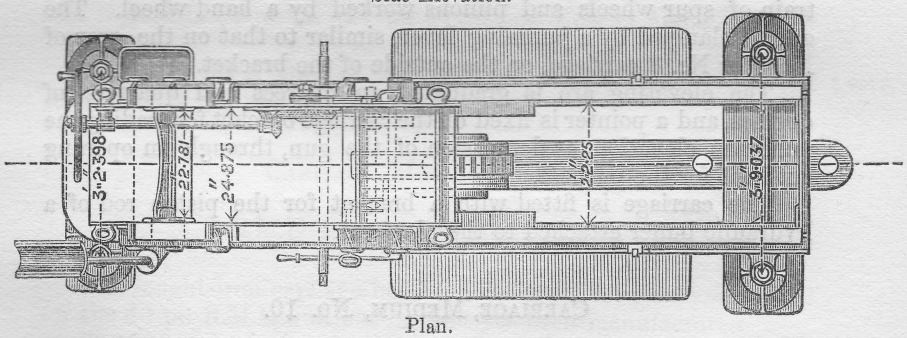
## Carriage, Medium, No. 8.

R.M.L. 64-pr. 64 cwt., 6′ Parapet, for Platform No. 8. § 3861. R.C.D. photo-lithograph, 68.

Fig. 59.




Side Elevation.




Plan.

This carriage, Fig. 59, is in general form similar to the preceding, but the brackets are single plate. There are five rollers on each side, the axles of which are supported in cast steel brackets attached to the outside of the carriage brackets.

Elevating gear.

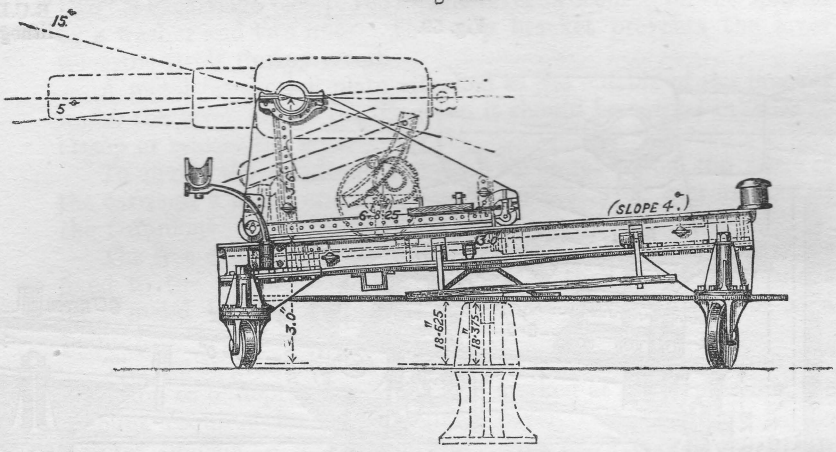
The elevating gear is similar to that for No. 7 carriage, but is fitted on the right side only

The carriage is not fitted with a hydraulic buffer; but is fitted with a rack under the bottom plate to gear into teeth on the rim of a circular buffer attached to the platform.

## Carriage, Medium, No. 9.

R.M.L. 64-pr. 64 cwt. for Platform No. 9.

Fig. 60.




The carriage. Fig. 60, is single plate, and is similar in general form to No. 8.

It is fitted with four metal rollers, the axles of the rear rollers being formed on an eccentric shaft, which is fitted with sockets to take iron pointed levers.

Elevating gear.

Elevating gear is fitted to the right side of the carriage only, and consists of an arc attached to the gun, which gears with a train of spur wheels and pinions worked by a hand wheel. The gear is clamped by a jamming lever, similar to that on the gear of No. 7 or No. 8 carriage, on the outside of the bracket.

The elevating arc is graduated in degrees and quarters of degrees, and a pointer is fixed on the carriage bracket for reading the quadrant elevation or depression of the gun, through an opening cut in it for the purpose.

The carriage is fitted with a bracket for the piston rod of a hydraulic buffer attached to the platform.

## Carriage, Medium, No. 10.

R.M.L. 64-pr. 71 cwt. for Platforms Nos. 11 and 12.

§ 4615.

This carriage is similar to No. 2 (see p. 195), but is not fitted with wood steps outside the brackets.

## Carriage, Medium, No. 11.

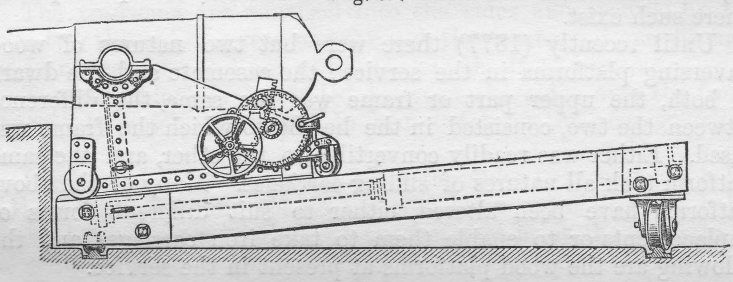
R.M.L. 64-pr. 71 cwt. for Platform No. 13.

This carriage is similar to No. 3 (see p. 196). § 4616.

## Carriage, Medium, No. 12.

R.M.L. 64-pr. 71 cwt. for Platform No. 19.

Fig. 61.



This carriage, Fig. 61, is similar in general form to No. 10, but is 3″ less in height. § 4617.

The elevating gear on each side consists of a spur pinion and wheel, transmitting the motion from a handwheel to an arc. The handwheels are connected by a cross shaft, to which the pinions are keyed, and the arcs by a cradle, on which the breech of the gun rests. The gear is clamped by a small clamp with screw, acting on each spur wheel. The carriage will admit of 13½° of elevation and 8½° depression. Elevating gear.

## Carriage, Medium, No. 13.

R.M.L. 64-pr. 58 cwt. for Platforms, Nos. 11 and 12.

This carriage is similar to No. 2, but is not fitted with wood steps outside the brackets. § 4212.

## Carriage, Medium, No. 14.

R.M.L. 40-pr. for Platform No. 10.

A wrought-iron carriage has been designed for garrison service for the 40-pr. R.M.L. gun but has not yet been manufactured.

The design of the carriage is generally similar to that of carriage No. 2. It is fitted with spur wheel elevating gear on the right side only, worked by a handwheel and clamped similarly to that of carriage No. 7 (p. 202).

## CHAPTER VI.—WOOD TRAVERSING PLATFORMS.

§ 4484. All platforms, whether of wood or iron, for medium guns, are now placed in a numbered series, corresponding to that for medium gun carriages (see p. 495)

§ 4533. Every platform included in the above series, issued in future, will have the distinguishing number employed in its official designation marked on the inscription plate.

Platforms already issued will be marked with their distinguishing numbers on the left side directly under the inscription plates, where such exist.

Until recently (1877) there were but two natures of wood traversing platforms in the service; the casemate and the dwarf. In both, the upper part or frame was the same, the difference between the two, consisted in the height to which the frame was raised. Either was readily convertible to the other, and the same platform took all natures of sliding carriages. Many of the above platforms have been altered, either to suit different forms of emplacements or to enable them to take iron carriages, and the following are the wood platforms at present in the service.

| No. of Platform. | Nature of Gun. | Length of Platform. | | Height of Parapet. | | Weight. | Tonnage. |
|---|---|---|---|---|---|---|---|
| | | ft. | in. | ft. | in. | cwts. | tons. |
| No. 11 (p. 210) .. | 7″ R.B.L. 82 cwt. 64-pr. 71 and 58 cwt. | 13 | 2 | 4 | 3 | 44 | |
| „ 12 (p. 210) .. | 7″ R.B.L. 82 cwt. 64-pr. 71 and 58 cwt. | 13 | 2 | 3 | 6 | 34¾ | |
| „ 13 (p. 210) .. | 7″ R.B.L. 82 cwt. 64-pr. 71 cwt. | 11 | 0 | 3 | 6 | 30¾ | |
| „ 14 (p. 207) .. | 7″ R.B.L. 82 cwt. 40-pr. R.B.L. 80-pr. R.M.L. 64-pr. 58 cwt. and 68-pr. S.B. 95 cwt. | 16 | 0 | 2 | 7 | 27 | 2·62 |
| „ 15 (p. 211) .. | 7″ R.B.L. 72 cwt. | 14 | 0 | 3 | 6 | 18¾ | |
| „ 16 (p. 209) .. | 7″ R.B.L. 82 and 72 cwt. 80-pr. R. M. L. 5 tons. 64-pr. 71 and 58 cwt. | 16 | 0 | 4 | 3 | 37 | |
| „ 17 (p. 208) .. | 40-pr. R.B.L. and all S.B. guns, and also R.M.L. guns A and B pivots | 16 | 0 | 4 | 3 | 33¾ | 2·62 |
| „ 18 (p. 209) .. | 80-pr. R.M.L. 5 tons, 64-pr. 71 and 58 cwt. | 16 | 0 | 6 | 0 | 53 | 10·801 |
| „ 19 (p. 211) .. | 64 pr. 71 cwt. | 13 | 2 | 2 | 7 | | |

## Platform, Traversing, Medium, No. 14.

(Designated in Vocabulary, 1882, as "Platform, wood traversing, casemate, rifled and S.B. guns.")

No. 14. R.C.D. photo-lithograph, 60A.

The platform is made of teak, and consists of two sides with cheeks, three transoms, one head block, four flanges, and four trucks.

The sides 16′ × 1′ × 1′, with the outer edges bevelled off, are placed 21″ apart; their ends are hooped, and the upper surfaces shod with iron plates. The cheeks are nailed to the sides to give sufficient bearing for the flanged feet.

The transoms are mortised into the sides and secured by tie bolts, two through the rear, one through the centre, and one through the front transom, and one at the back of the front transom.

The head block is dovetailed between the sides over the front transom, to which it is bolted, to form a stop for the carriage when run up.

Four bolt holes are bored through the sides to receive the bolts of the flanged feet, and behind the rear holes are nailed two half-moon pieces to form bearings for the feet, and bring the platform to the required slope of 5°.

The front flanges are of metal, the rear of cast-iron, each secured by a single bolt, which for the front is 8″ long, and for the rear 13½″. The front flanges are fitted with two small plates of iron under the axle bearings, which pivot on studs, and enable the roller to be removed and cleaned when necessary.

The trucks are of wrought-iron, hollow soled; the front 4⅞″ in diameter, and the rear 12″; the front are formed in one piece with their axles.

The fittings of the platforms are: four battens between the rear and centre transoms for men to stand on, a bollard for preventor rope on the inner side of the left side, iron stops to receive the carriage on recoil, 15″ from the ends of the sides, eyebolts for tackle, two on each side, a bent plate between the sides in rear with hole for the pintail of the transporting dilly, and axletree bands for the transporting axle.

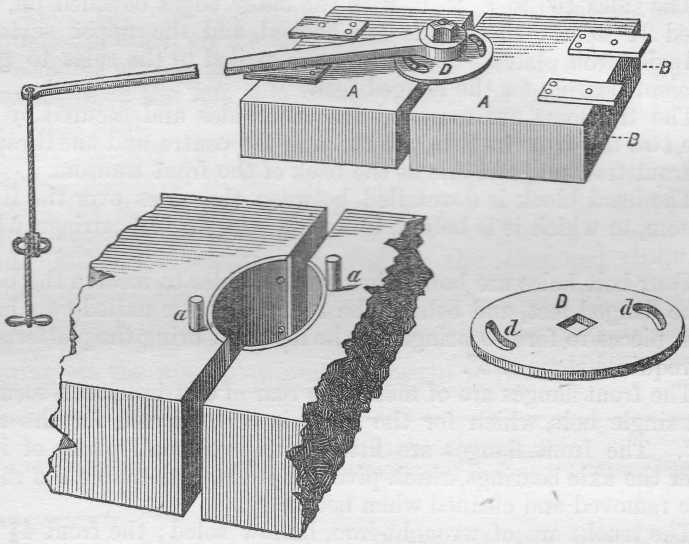
The "wooden" compressor.

To check the recoil of the 7″ R.B.L., 64-pr. or 80-pr. R.M.L., 10″, 8″, or 68-pr. S.B., when mounted on a sliding carriage, the compressor known as the "wooden" compressor, Fig. 62, is used. It is made of three different sizes, 1′ 5″ long for the 7″, 2′ 4¼″ for the 10″, 80-pr. and 68-pr., and 1′ 10″ for the remaining gun carriages.

The compressor consists of two cheeks, A, A, of elm, held together by two guide bolts, B, B, in such a manner that they fit tightly in one cheek, but slide easily in and out of the other, being prevented sliding beyond certain limits by nuts. An iron eccentric is fitted between the cheeks in metal bearings, and through it a square bolt passes from the under side: over the bolt, resting upon the upper surfaces of the cheeks, an iron disc D is placed, and above it a lever handle, with fall and toggle, is nutted on the bolt. In the

iron disc are two slotted holes, *d*, *d*, through which a small iron stud *a* on each cheek projects. Two short iron plates project on each side of the compressor, and serve to support it, as it lies between the sides of the platform beneath the carriage: its lever is on the right, and when drawn to the rear the eccentric presses the

Fig. 62.




sides of the compressor against the sides of the platform, fixing it therefore more or less to the latter; the carriage, however, to recoil must carry the compressor with it, and therefore the recoil is checked. To remove the compression for running up, the lever is drawn to the front, when the slots in its iron disc working on the studs in the cheeks bring the latter together and free of the platform.

If from wear of the outer sides of the cheeks the lever fouls the rear block of the carriage before the required amount of compression is obtained, the lever must be cranked. If the sides are so worn as to be flush with the guide bolts, the metal bearings must be removed and pieces of leather packed between them and the woodwork.

When not in use the compressor should be removed from the platform to store.

## Platform, Traversing, Medium, No. 17.

(Designated in Vocabulary, 1882, as "platform, wood, traversing, dwarf, R.B.L. 40-pr., and S.B. guns.")

No. 17. R.C.D. photo-lithos., 60, 60B

The dwarf platform differs from the preceding, in having a block which fits under the sides in rear, beneath the half-moon

pieces, and takes the bearing of the flanges instead of the latter, the bolts of the flanges passing through it. Two dowels project from it and enter the rear transom. The bolts of the rear flanges are 25″, and of the front 13½″ (*i.e.*, the same as the rear of the casemate); the front and rear trucks are 12″ in diameter (the same as the rear in the casemate). The platform is also fitted with side steps, a long one on the right and a short on the left.

The platform is intended to fire over a 4′ 3″ parapet.

## Platform, Traversing, Medium, No. 16.

(Designated in the Vocabulary 1882, as "platform, wood, traversing, dwarf R.B.L. 7″ and R.M.L. 80 and 64-prs.") No. 16. § 3576.

This platform is similar to the preceding, but is fitted with a pivot plate with four 3″ holes for pivot plugs, the position of the holes being suitable for C, D, E and F pivots.

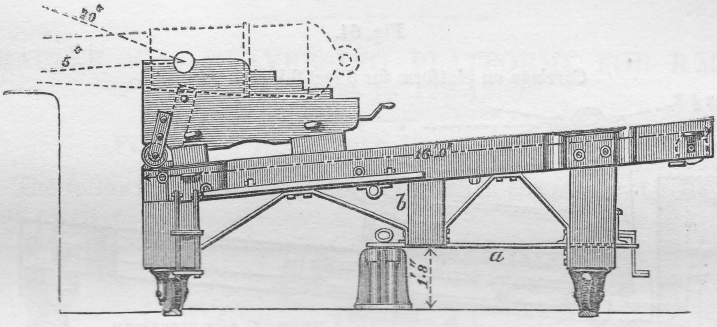
The plate is fixed under the centre line of the platform, and is secured to the rear block, and to a block of wood fixed across the platform.

## Platform, Wood, Traversing, No. 18.

§ 4485. No. 18. R.C.D. photo-lithograph, 59B).

R.M.L. 80-pr. and 64-pr. of 71 and 58 cwt., to fire over 6′ parapet.

Fig. 63.




The platform, Fig. 63, is converted from either platforms Nos. 14, 16 or 17 when required, for under cover loading. It admits of fire over a 6′ parapet with 5° depression. The requisite height is obtained by bolting blocks of teak strengthened by iron stays under the frame of platform. The pivot plate is similar to that for No. 16 platform. There are three double steps fitted, one to each side of the platform near the front, and one on the right side of the rear block.

An iron loop is bolted to the centre of the front truck block, for the attachment of a tackle for depressing the gun for loading. An iron cleat is fixed to the centre block for the fall. § 4632.

§§ 4210, 4212. No. 11.

### Platform, Wood, Traversing, Medium, No. 11.

R.B.L. 7″ 82 cwt.. R.M.L. 64-pr. 71 and 58 cwt. 4′ 3″ parapet for iron carriages Nos. 2, 10 and 13 (13′ 2″ long).

The platform, Fig. 54, is converted from the dwarf platforms, Nos. 16 or 17. The same trucks and flanges are used, the radii of the racers being unaltered, but the platform is reduced in length to 13′ 2″. The platform is strengthened inside each side by an iron plate, to which is riveted a plate for the clips of the carriage, the rear block is supported by stays of plate and angle iron, secured along the under side of each side and to the block. It is fitted with a hydraulic buffer which is supported by a wrought-iron bracket at the rear, and rests on and is secured to the rear and centre transoms.

The buffer cylinder is 5′ 9″ long, 7″ external diameter, and about ·5″ thick. It is closed at each end by a wrought-iron cap. The piston and piston rod are of wrought-iron. The piston has four holes ·7″ diameter. The working contents will vary with the charges used; for charges of 6 lbs. and under, the cylinder must be empty.

The pivot plate is similar to that for No. 16.

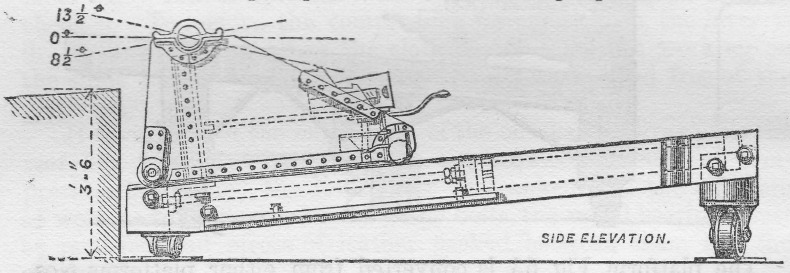
§ 4212. No. 12.

### Platform, Wood, Traversing, Medium, No. 12.

R.B.L. 7″ 82 cwt., R.M.L. 64-pr. 71 and 58 cwt., 3′ 6″ parapet for iron carriages Nos. 2, 10 and 13 (13′ 2″ long).

Fig. 64.

Carriage on platform for 3 feet 6 inches parapet.




This platform, Fig. 64, is similar to No. 11, with the exception that the rear block is reduced in height and has no stays. There is no pivot plate, and the front flanges and trucks are special.

§ 4209. No. 13.

### Platform, Wood, Traversing, Medium, No. 13.

R.B.L. 7″ 82 cwt. and R.M.L. 64-pr. 71 cwt. for iron carriages Nos. 3 and 11 (11′ long).

This platform, Fig. 55, is similar to No. 12, but is reduced in length to 11′, and fitted with bars and tripper for the E.O.C. compressor.

PLATFORM, WOOD, TRAVERSING, MEDIUM, No. 15. No 15.

R.B.L. 7″ 72 cwt. for wood carriage No. 18.

(Designation in Vocabulary, 1882, slide, wood, siege equipment R.B.L. 7″.)

This platform was originally converted for siege service from the naval slide, p. 355. The slide was raised to a slope of 4° by a front and rear block, a siege axletree was fitted in the rear block, and a hole for the pintail of a limber in the head.

The slide was intended to be mounted on a ground platform, to which it was pivoted by a fighting bolt in front.

The siege service slide is converted for garrison service by removing the axletree in the rear block.

The ground platform is formed of two oak baulks forming the sides, housed over and secured by iron pins to two oak transoms. The front transom has a hole in it for the pivot bolt of the slide.

In laying the platform, the transoms are bedded in the ground.

PLATFORM, WOOD, TRAVERSING MEDIUM, No. 19. No. 19.

2′ 7″ parapet R.M.L. 64-pr. 71 cwt. for carriage No. 12.

This platform, Fig. 61. is similar to No. 12 for 3′ 6″ parapet, and has a hydraulic buffer, but it has no rear block, and the front trucks are only $4\frac{7}{8}$″ diameter § 4617.

## CHAPTER VII.—TRAVERSING PLATFORMS FOR R.M.L. GUNS, 7-INCH TO 12·5-INCH.*

### PLATFORMS FOR SINGLE PLATE CARRIAGES.

The following table gives the platforms in the service for single plate carriages:—

Table.

| Nature. | Weight. | Tonnage. | Width between sides. | Length. | Diameter of Trucks. | | Height to axis of gun run up. | Slope of platform. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Front. | Hind. | | |
| | cwt. qrs. | tons. | ft. in. | ft. | in. | in. | ft. in. | ° |
| 7″ R.M.L. casemate | 55 2 | 3·975 | 2 $10\frac{1}{2}$ | 15 | 6 | $10\frac{1}{2}$ | 4 1 | 5 |
| ,, dwarf .. | 69 2 | 3·475 | ,, | ,, | $10\frac{1}{2}$ | $15\frac{1}{2}$ | 5 $8\frac{1}{2}$ | ,, |
| 9″ R.M.L. casemate | 57 3 | 3·975 | ,, | ,, | 6 | $10\frac{1}{2}$ | 4 $1\frac{1}{2}$ | ,, |
| ,, dwarf .. | 74 0 | 3·475 | ,, | ,, | $10\frac{1}{2}$ | $15\frac{1}{2}$ | 5 9 | ,, |
| 12″ R.M.L. casemate | 80 1 | 5·000 | 4 $6\frac{1}{2}$ | ,, | $7\frac{1}{2}$ | $10\frac{1}{2}$ | 4 $11\frac{1}{2}$ | ,, |
| 12″ R.M.L. casemate fitted with buffer and traversing gear. | 102 0 | 6·027 | ,, | ,, | ,, | ,, | ,, | ,, |

* For 10·4″ M.L. mounting see Appendix H.

§ 1584. The general construction of these platforms is similar to that of those for double plate carriages (see p. 215). The trucks are smaller and the flanged feet longer.

Fittings. The platforms issued for the first pattern single plate carriages, viz., 7″ or 9″, were fitted for the American compressor by having a baulk of sabicu bolted longitudinally down the centre, and on either side of this two others supported on bolts, passing across the platform through their ends, on which they could move towards or from the centre baulk.

The platforms issued for the second pattern single plate carriages were fitted for the Elswick compressor by having bars of plate iron, supported by pins through their ends, down the centre of the platform, in the same manner as the baulks for the American compressor, but all moveable. To prevent the bars from closing too much upon each other iron collars were strung upon the pins between them. The pins were supported in brackets, and secured by split keys ; the front bracket was bolted to the front transom of the platform, and the rear bracket to a bent plate fitted between the sides.

As already explained, to make the compressor self-acting, a steeled piece of iron termed a "tripper" was pivoted on a spindle projecting from a bracket bolted to the right side of the platform ; a stop was formed on the bracket for the tripper to bear against when called into action.

Some of the first issued platforms were fitted to take a round transporting axle.

Platforms for single plate carriages, when returned to R.C.D., are converted to take the hydraulic buffer, and otherwise brought up to date.

### Converted Naval Slides.

Some naval slides have been converted to land service platforms for use with converted carriages (p. 163).

§ 5101. The conversion is similar for the 8″ and 9″. The sides are
§ 5102. strengthened by the addition of steel plates, ·75″ thick riveted to
§ 5103. their webs on both inside and outside.

The rollers and their side flanges are removed and W.I. trucks and flanges with flanged plates, arranged to give the upper surface of the sides a slope of 4°, substituted for them. The trucks are flat soled. Each is formed in two parts which run on the same axle. Width of sole, 2·45″ ; diameter of front trucks, 5·6″ ; of rear, 12″. The axles are steel, 2·39″ diameter, and are secured in the flanges each by two nuts.

In the 8″ platform the pinion on the front end of the traversing shaft, which geared with the rack on the deck, is replaced by a metal upper pinion, 8″ diameter, 16 teeth, which gears with a similar lower pinion, on a W.I. spindle, 2·25″ diameter, secured by a pin in bearings in two metal brackets, attached each by four ·75″ bolts, to a cross plate. The lower pinion gears with a fixed cast-iron rack in the floor of the work.

In the 9″ platform the traversing shaft on the slide is replaced by another 7′ long, the front end of which is supported in a metal

bearing bolted underneath the cross plate. The pinions of the naval slide are used with this shaft.

The pivot plates with pivot heads are replaced by two plates with double loops, to which a pivot bar is attached by steel pins. This bar is connected with a pivot block, by a pivot plug, which is secured to the bar by a set screw.

A bearing plate for the piston rod of the hydraulic buffer is riveted to the front of the webs of the girders, and a circular hole is cut in the front transom to allow the front of the buffer to enter it.

The 7″ platform is strengthened, given a slope of 4°, and is fitted with new pivot plates, and cast-iron instead of metal rollers.

WROUGHT-IRON PLATFORMS FOR DOUBLE PLATE CARRIAGES FOR R.M.L. GUNS FROM THE 7-inch 7 TONS TO THE 12·5-inch.*

The following table gives the natures of the above platforms in the service:—

| Nature. | Weight with Gear. | Tonnage. | Width between sides. | Nominal Length. | Slope. | Diameter of Trucks. | | Height to axis of Trunnions from outside edge of racer. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Fore. | Hind. | |
| | cwts. | tons. | in. | ft. | ° | in. | in. | ft. in. |
| 7″ R.M.L. casemate, fitted for E.O.C. compressor | 56¼ | 3·700 | 34½ | 15 | 4 | 8½ | 13 | 4 1 |
| Ditto, fitted for buffer .. | 53 | 3·864 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 7″ R.M.L. dwarf "A," fitted for buffer | 77¾ | 7·158 | ,, | ,, | ,, | 18 | 24 | 5 8½ |
| 7″ R.M.L. dwarf "C," fitted for buffer | 80¾ | 6·733 | ,, | ,, | ,, | 24 | 24 | ,, ,, |
| 7″ R.M.L. dwarf "D," fitted for buffer | 80¾ | 7·350 | ,, | ,, | ,, | 24 | 18 | ,, ,, |
| 9″ R.M.L. casemate, fitted for E.O.C. compressor | †65½ | 4·075 | 42 | ,, | ,, | 8½ | 13 | 4 1½ |
| Ditto, with buffer, old gear | 69 | 5·695 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| Ditto, gear to work within length | 74¾ | ,, | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 9″ R.M.L. casemate, Elswick pattern | 63¼ | 3·975 | ,, | ,, | ,, | 19½ | 13½ | 4 9½ |
| 9″ R.M.L. dwarf "A," fitted for E.O.C. compressor | †90½ | 8·425 | ,, | ,, | ,, | 18 | 24 | 5 9 |
| Ditto, with buffer .. .. | 97 | 9·045 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 9″ R.M.L. dwarf "C," fitted with buffer | 101½ | 7·612 | ,, | ,, | ,, | 24 | 24 | ,, ,, |
| Ditto, "C, central" .. | 110 | 6·943 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 9″ R.M.L. dwarf "D," fitted with buffer | 107 | 7·900 | ,, | ,, | ,, | 24 | 18 | ,, ,, |
| 10″ R.M.L. casemate, Mark I, with buffer | 95½ | 6·654 | 47 | ,, | ,, | 10 | 13 | 4 2½ |
| Ditto, gear to work within length | 97¼ | 4·546 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 10″ R.M.L. casemate, Mark II, with buffer | 106¼ | 5·782 | 49½ | ,, | ,, | 18 | 18 | ,, ,, |
| Ditto, gear to work within length | 104 | 6·683 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| Ditto, special .. .. | 125 | 7·018 | ,, | ,, | ,, | ,, | ,, | 4 11½ |
| 10″ R.M.L. dwarf "A," with buffer | 134¼ | 7·845 | 47 | ,, | ,, | ,, | 24 | 6 0 |

* Platforms 80-pr. and upwards mounted on sea fronts will be fitted with steel posts and wood steps to facilitate firing at moving objects. § 5248.

† Without gear.

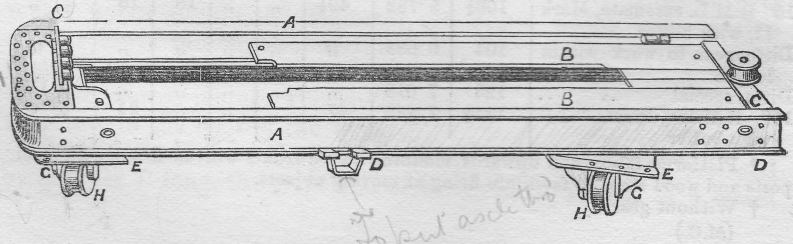
| Nature. | Weight with Gear. | Tonnage. | Width between sides. | Nominal Length. | Slope. | Diameter of Trucks. | | Height to axis of Trunnions from outside edge of racer. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Fore. | Hind. | |
| | cwts. | tons. | in. | ft. | ° | in. | in. | ft. in. |
| 10″ R.M.L. dwarf "C," with buffer | 136¾ | 8·035 | 47 | 15 | 4 | 24 | 24 | 6 0 |
| Ditto, "C, central" .. .. | 140½ | ,, | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 10″ R.M.L. dwarf "D," with buffer | 141 | 8·507 | ,, | ,, | ,, | 24 | 18 | ,, ,, |
| 10″ R.M.L., small port .. | 106 | 5·872 | ,, | ,, | ,, | 13 | 13 | 5 7½<br>4 7½ |
| 11″ or 12″ R.M.L. casemate, fitted for E.O.C. compressor | *98½ | 5·850 | 56 | ,, | ,, | 10 | 13 | 4 11½ |
| 11″ or 12″ R.M.L., casemate, with buffer | 115 | 6·085 | 56 | 15 | 4 | 10 | 13 | 4 11½ |
| Ditto, gear to work within length | 112 | 5·869 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 11″ or 12″ R.M.L. dwarf "A," with buffer .. | 139¼ | 7·729 | ,, | ,, | ,, | 18 | 24 | 6 3 |
| 11″ or 12″ R.M.L. dwarf "C," with buffer | 136¾ | 7·514 | ,, | ,, | ,, | 24 | 24 | ,, ,, |
| Ditto, "C, central" .. | 142½ | 6·976 | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| 12″ R.M.L. 35 tons, dwarf "C." with buffer | 186¾ | 8·749 | 60¾ | 15½ | ,, | 24 | 24 | 6 0½ |
| 12·5″ R.M.L. 38 tons, casemate, 6′ recoil, Marks II and III | 162¼ | 6·249 | ,, | ,, | ,, | 13 | 18 | 4 11½ |
| Special Mark III .. .. | 162¾ | ,, | ,, | ,, | ,, | ,, | ,, | ,, ,, |
| Ditto, 7′ recoil, Marks II and III | 163½ | 7·097 | ,, | 16½ | ,, | ,, | ,, | ,, ,, |
| 12·5″ R.M.L. 38 tons, dwarf "C," 6′ recoil, Marks II and III | 188¼ | 8·522 | ,, | 15½ | ,, | 24 | 24 | 6 0½ |
| 12·5″ R.M.L. 38 tons, dwarf "D," 6′ recoil, Marks II and III .. | 184¼ | 9·606 | ,, | ,, | ,, | 24 | 18 | ,, ,, |
| 12·5″ R.M.L. 38 tons, small port, 6′ recoil, Marks II and III | 169¼ | 6·766 | ,, | ,, | ,, | 13 | ,, | 5 11½<br>4 7½ |
| 12·5″ R.M.L. 38 tons, small port, 7′ recoil, Mark I | 150 | 7·097 | ,, | 16½ | ,, | ,, | ,, | ,, ,, |

* Without gear.

## 7″ R.M.L. of 7 Tons Casemate Platform. Mark I.

The platform consists of two sides, A, A, two transoms, C, C, two bottom plates, D, D, two truck plates, E, E, a top plate, F, a diagonal stay, four flanged feet, G, G, and four trucks, H, H.

Fig 65.




7″ R.M.L. of 7 tons casemate platform. Mark I. (See R.C.D. photolithograph, 61.) § 1635. Construction.

The sides are of girder iron, 10″ deep, and 5½″ wide in the tee; they are planed upon the upper and under surfaces, as well as along the sides of the tees. The front ends are bent at right angles, till they meet to form the breast of the platform, where they are held together by a plate, which overlaps the junction on the inside, and is bolted to the webs. The head of the platform is strengthened by the front transom and the top plate; the former is a plate of iron riveted along the top and sides to a frame of angle iron: it is let into the girders a foot from the breast, and is bolted to them.

The top plate is bolted over the breast and front transom; a longitudinal aperture is slotted in it, to give access to nuts beneath, and its width is such as not to interfere with the rollers of the carriage.

The rear ends of the girders are connected by the rear transom and the rear bottom plate. This transom is of girder iron, 7″ deep, and is attached to the sides by knee plates bolted to it and to the webs of the girders. The rear bottom plate is bolted underneath the rear of the platform to the transom and sides. The truck plates, to which are attached the flanged feet for the trucks, are bolted beneath the sides, one in front, the other 10′ more to the rear; between the latter plate and each side is placed an angular packing piece of iron; in order to give the platform the necessary slope. The flanged feet consist each of a fore and hind flange or knee, forged from scrap, with holes through them to receive the axles of the trucks. Those in front are bolted directly to the truck plate; those in rear are first riveted to a connecting plate. They are so placed that the positions of the trucks shall suit the curve of the racers, and that they shall be at the proper distances from the pivot.

The trucks are of wrought-iron bouched with metal; they are cylindrical and flanged, the rear trucks having, however, a flange on their front sides only. Their axles are of steel, 2⅜″ in diameter; each is secured in its flanged foot by two nuts on the inside.

Between the truck plates the sides are held together by the front bottom plate, and braced by the diagonal stay. This bottom plate lies between the lower tees of the sides, midway between the truck plates; to avoid weakening the sides at that point by bolt holes, it is not secured by bolts, but by clips, which overlap the lower tees of the girders on the outside, and are bolted to the plate itself. Formerly bands for a transporting axle were attached to these clips, and the latter were slotted to allow the linch-pins to be placed. These bands are now discontinued, as are also the eyes for the transporting limber. § 3575.

The diagonal stay is of 1″ plate, and is formed by a centre piece, to which four arms are welded in the form of the letter X; the extremities of the arms are bolted to the sides, and its centre to the front bottom plate.

A foot plank B, for standing upon, of sabicu or teak, 10″ wide, with a supporting block attached beneath each extremity, Fittings.

lies from one bottom plate to the other. along the inside of each side of the platform. The space left in the centre between the planks is for the bars of the Elswick compressor, or for the hydraulic buffer; if the platform is for the former the planks are bevelled off on the inner edge, and two short 6″ planks fill the space between the ends of the bars and the rear transom.

A bollard for the preventor rope is fitted upon the rear transom; the bollard is of sabicu, and fits upon an iron spindle, on which it is held by a nut; the spindle is bolted to the transom. If the platform is fitted with a buffer, the bollard is 9″ high, if for the compressor, 6″ high.

To form stops for the carriage when run up, a piece of angle iron is bolted on the top plate, and a piece of sabicu to the rear of this, to which four buffers are fitted, consisting each of an india-rubber ring 2″ thick, upon a spindle 6½″ long, with a large and nearly flat head. The spindle with the ring on it passes through the sabicu block and angle iron, and is secured in front by a flat key.

To form stops for the carriage in recoil, an iron bracket with projecting stop is bolted on the inside of each side of the platform, 3′ 2½″ from the end if the platform is fitted for the buffer, and 1′ 2″ if fitted for the compressor. Each stop has an india-rubber ring, the same as in the front stop, but with a spindle 2″ shorter.

§ 4825. In future, buffer stops consisting of alternate rings of felt and galvanised iron will be substituted for the rings of the india-rubber. The issue will be made after existing stores of india-rubber rings are exhausted.

Eye bolts for tackle are bolted one in front and one in rear on each side.

Staples are bolted to the right side in front and rear to receive iron brackets on which the side arms rest. Metal brackets are also bolted to each side for carrying an iron-pointed lever. Upon the right side of the platform in rear there are staples for attaching a sponge tank.

A movable platform board or stage, extending from the stops to the rear, resting upon the side, is fitted across the platform; it is grooved and secured by studs, which fit into holes in the girders.

If the platform is fitted for the Elswick compressor, the fitments are as follows :—

A bracket to support the bars in front is bolted to the back of the front transom.

A bracket to support the bars in rear is bolted to a bent plate, which is fitted between the sides and bolted to their lower tees, just over the rear truck plate.

A small bracket with spindle and stop for the tripper, is bolted to the right side near the front.

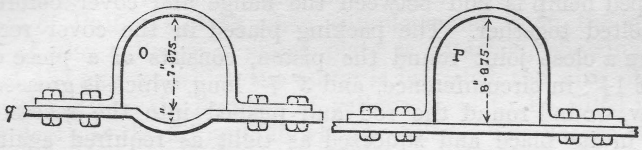
Six compressor bars ⅝″ thick, 10′ 10″ long, and 6½″ deep, are hung in their supporting brackets by pins, which are secured by keys; an iron ring or collar being placed on each pin between the plates.

The tripper is of iron steeled, and is secured on its spindle by a collar and key.

If the platform is fitted for the hydraulic buffer, the following are the fittings:—

A bearing plate *q* (Fig 66), bolted across the platform on the diagonal stay for the support of the front of the buffer.

Fig. 66.




Two holding-down bands, *o*, *p*, which, when the buffer is placed, lie over it and are bolted, one to the bearing plate, the other to the rear bottom plate. The front band *o* is 1″ lower than the rear *p*, in the former there is a hole for a set screw, to secure the buffer from turning. The rear bottom plate and the lower tee of the rear transom are slightly hollowed out to form a bed for the end of the buffer, and the upper tee of the transom is slotted. A hole is also made in the plate of the front transom, for the piston rod to enter when the carriage is run up.

A plate staple is secured by screws upon the inside of the right side towards the rear, for holding the spanner for moving the plug and cock.

The weight of the hydraulic buffer is $4\frac{3}{4}$ cwt., its tonnage ·222 ton, and its greatest length and diameter respectively 87·5″ and 14″. It consists of the following parts, namely:— The hydraulic buffer. (See R.C.D. photo-lithograph, XIII.) L. of C., § 3147. § 4910.

Cylinder *a*, Fig 67, of wrought-iron (since 1886 of steel).

Cover *d*, of cast-iron, with eight bolts.

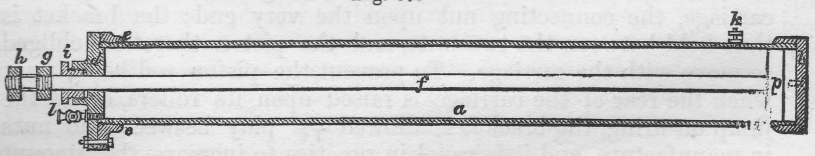
Flange *e* „

Cap *b* „

Piston *p*, of wrought-iron.

Piston rod *f*, of wrought-iron, with collar nut *g*, and connecting nut *h*.

Fig. 67.




Plug *k*, for filling hole, of wrought iron.

Packing gland *i*, of metal.

Emptying cock *l*, of metal.

The cylinder internally is 77·375″ long, and 8·07″ in diameter; the cap screws upon and closes one end, while the flange screws

upon the other. The cover, through which there is a hole for the piston rod to pass, and on the outer side round that hole a recess for packing, is bolted to the flange, so closing the cylinder at that end. Both the flange and the cover are flat on their upper edges, to admit of the carriage in recoil passing over them, and the thread on the flange is so cut, that when screwed home, the flat edge will come to the proper position To make close joints, Scott's mineral composition is smeared over the screw threads of the cylinder and flange, before the latter is put on, and the same mixed with chopped hemp is laid between the flange and cover before they are bolted together. The packing placed in the cover recess, to ensure a close joint round the piston, consists of a piece of tow about $1\frac{1}{4}''$ in circumference, and 3′ 7″ long, which is greased with tallow, wound round the rod and pushed into the recess. It is kept in its place and squeezed as tight as required against the rod by the packing gland, which passes over the rod and screws into the recess, and in this manner is made so tight that a man can just move the rod in or out.

If cotton rope is available it may be used instead of tow, in three rings as in packing siege buffers, p. 83. A special spanner is made for turning the gland, but the knock-up wrench will serve the purpose. A zinc pan to catch any drip from the gland in firing is suspended from the front of the buffer. A hole is drilled and tapped in the upper surface of the cylinder near the rear end for filling it through, and is closed by the screw plug, which is secured by a chain to the right footboard of the platform, and a small recess is cut near the front end for the set screw to secure the buffer from turning. For emptying the cylinder a hole is drilled and tapped in the under part of the cover in front, in the same vertical plane as the filling hole when the buffer is in position, and is closed by the metal cock. A small spanner is issued for the buffer, one end of which turns the cock, and the other the filling-hole plug.

§ 4431. The piston is 8·04″ in diameter, and has four circular holes, each 1·25″ in diameter, drilled through it. It has been approved that one of the four 1·25″ holes in the piston is to be stopped. This is done by countersinking the edges of the hole, inserting an iron plug, and securely riveting it over. The piston rod screws into the piston and is secured by a keep screw. The collar nut screws on to the rod a few inches from the end, and the buffer being in position, and the end of the rod passed through the bracket on the carriage, the connecting nut upon the very end; the bracket is thus held between the two nuts, and the piston therefore obliged to move with the carriage. To prevent the piston rod being bent when the rear of the carriage is raised upon its rollers, or by the jump on firing, the bracket is allowed $\frac{1}{16}''$ play between the nuts in manufacture, and it is usual in practice to increase the amount of the play by giving the connecting nut half a turn back after having screwed it home.

In connecting the buffer to the platform the cap is made to bear fairly against the rear transom, the flat edges of the flange and cover are brought parallel to a straight edge laid over it across

the sides of the platform, and at right angles to them, and before bolting down the bands, leather packing pieces are placed between them and the cylinder in order that they may be made tightly to grip the latter.

For use the buffer is filled with 12 gallons of Rangoon oil, which may be measured in a gallon measure issued for the purpose, or tested by measuring the depth at the filling hole, which with the platform standing at the correct slope of 4°, and the carriage being run out to the front stops, should be $4\frac{5}{8}$″.

Excepting the rod, nuts, and metal parts, the buffer receives two coats of Pulford's black when complete, and upon the upper surface of the cylinder a metal plate is attached, showing the nature of the gun for which the buffer is intended, the size of the holes in the piston, the number of gallons it is to be filled with, and the depth at the filling hole when so filled. The nature of the gun is also marked on the piston rod between the nuts.

Altering a platform fitted for E.O.C. compressor to take the buffer.

To alter a platform fitted for the Elswick compressor to take the buffer, the bracket supports for the bars are removed, the hole cut in the front transom for the end of the rod, the tees of the rear transom cut, the stops moved further forward, and a higher bollard fitted upon the transom, after which the usual fittings for the buffer and the plate staple for the small spanner are added.

Marking.

A brass plate is attached to the rear transom with the nature of platform, mark, weight, date of manufacture, and register number engraved upon it.

Painting.

All the under surfaces of the platform receive one coat of red lead and then one of Pulford's black, the remainder receives two coats of Pulford's black, bearing surfaces excepted, such as the surfaces of the sides on which the carriage slides the soles of the trucks and bearing portions of their axles, &c. The register number is painted in white on the rear transom, and a line is also painted in white on each side to show when the carriage is run up.

## 7″ R.M.L. of 7 Tons Dwarf Platform, "A" Pivot. Mark I.

7″ R.M.L. of 7 tons dwarf platform, A pivot, Mark I. (See R.C.D. photo-lithograph, 61B.)

This platform only differs in construction from the preceding, in being made of greater height. This is arranged by using 18″ trucks in front and placing a block of sabicu $5\frac{1}{4}$″ thick, with an inch plate on it, and angular packing pieces above the plate, between the sides and the front truck plate, the fore and hind flanges of the front feet being connected by a plate in the same manner as the hind. In rear 24″ trucks are used and an iron knee stay placed between each side and the truck plate.

The fittings of the platform are the same as before, with the addition of a side step bolted from one truck plate to the other on each side of the platform.

## 7″ R.M.L. of 7 Tons Dwarf Platform "C" Pivot. Mark I.

7″ R.M.L. of 7 tons dwarf platform, C. pivot, Mark I. (Plate XXXV.)

This platform is raised to the same height as the dwarf A, by placing an angular packing piece between each side and the front truck plate, and a knee stay between each side and the rear truck plate; 24″ trucks are used both front and rear, the fore and hind flange of each foot being bolted to a connecting plate.

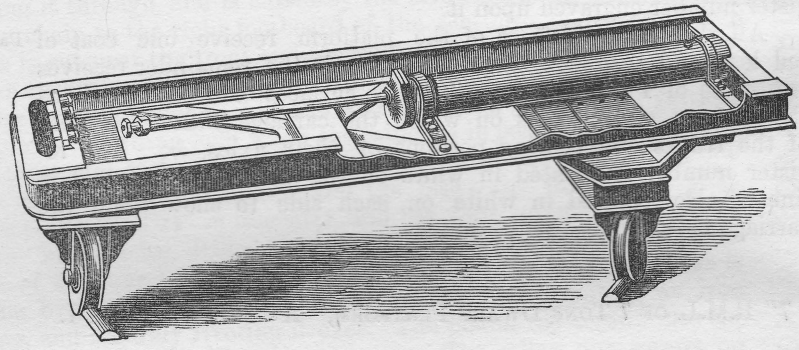
A longitudinal pivot plate and a cross stay are fitted to the platform for the purpose. The cross stay is a bent plate with pivot hole in the centre, which is bolted beneath the front bottom plate. The pivot plate extends from one truck plate to the other in the centre of the platform, and is bolted to those plates with packing pieces between, and to the cross stay; it has a pivot hole in it corresponding to the hole in the latter.

## 7″ R.M.L. of 7 Tons Dwarf Platform "D" Pivot. Mark I.

7″ R.M.L. of 7 tons dwarf platform, D pivot, Mark I.

The dwarf D differs (see Fig. 68) from the dwarf C platform in having 18″ trucks in rear instead of 24″, and in addition to a knee stay between each side and the rear truck plate, a sabicu block and plate. The pivot hole is in the pivot plate, not shown in Fig., just in front of the rear truck plate.

Fig. 68.



## 9″ R.M.L. of 12 Tons Casemate Platform. Mark I.

9″ R.M.L. of 12 tons casemate platform. Mark I. (See R.C.D. photo-lithograph, 129 and 129A.)

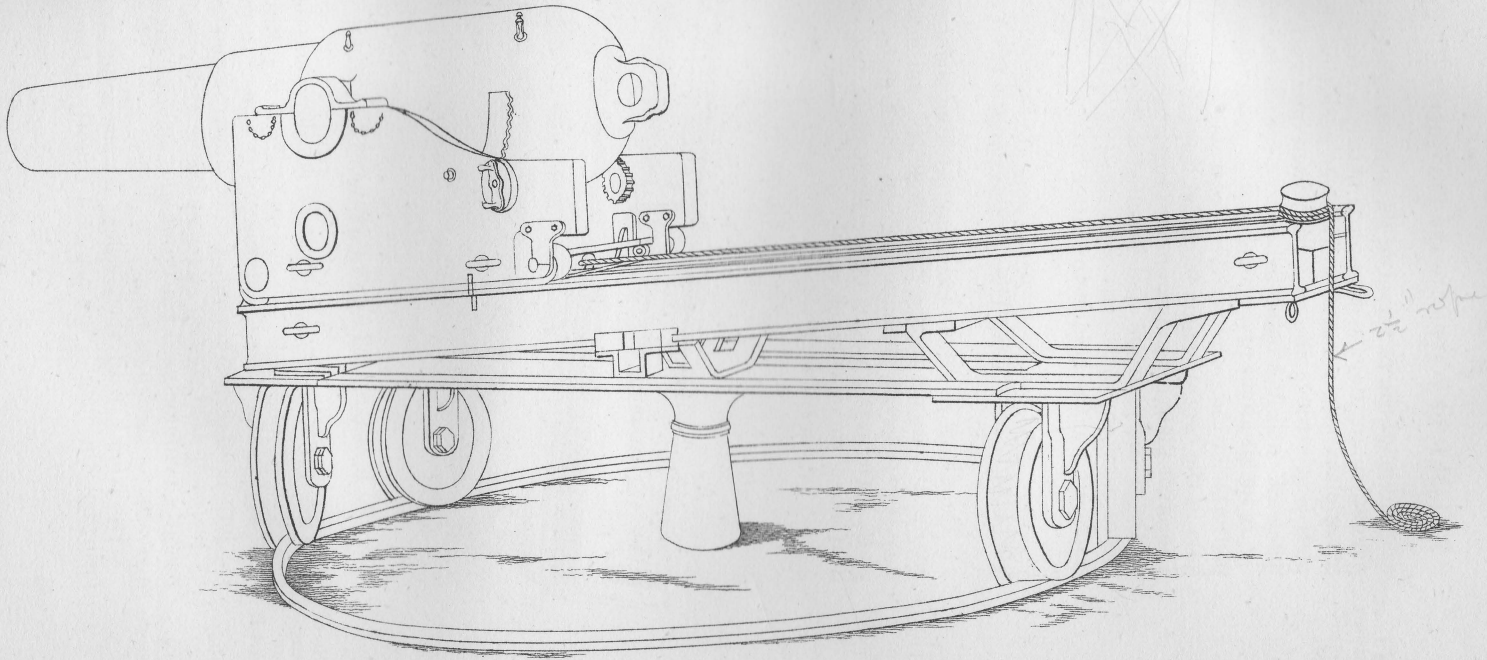
Construction.

This platform is of precisely similar construction to the 7″ casemate, differing from the latter only in the width between the sides and in the strength of the girder iron. In the first made 9″ platforms the sides were found to be too weak and were strengthened by plates of iron riveted along each side of the web; in the more recently manufactured platforms the web of the girder has been increased in thickness from 1″ to $1\frac{1}{2}$″.

The trucks, with their axles, are the same as in the 7″ platform, but the flanges are set at a slightly different angle to those

# 7 INCH 7 TON Wt IRON CARRIAGE AND DWARF PLATFORM.

## (C PIVOT.)




To face page 220.

Dangerfield Lith. 22 Bedford St. Covent Garden.

of the latter platform on account of the difference in the width between the sides.

Platforms for casemates, where the pivot is 12″ from the inside of the port, have the trucks 3″ further to the rear than in the original pattern, and have also the india-rubber buffers removed, which when the loop on the front transom of the carriage is also removed, admits of the muzzle of the gun protruding sufficiently when run up for firing.

Fittings. If the platform is fitted for the Elswick compressor, the tripper, which is longer than that on the 7″ platform, is the only fitment not interchangeable with those of the latter platform. The foot planks are 9″ wide.

If fitted with the hydraulic buffer, the latter itself is not interchangeable with the 7″ buffer, on account of the holes (four) in the piston being ·9″* in diameter instead of 1·25″. The foot planks are 12″ wide.

A folding pointer for use with a graduated arc on the floor of the casemate is attached to the right rear of the platform; it is of iron with a steel point.

Platforms for the 9″ gun are fitted with "traversing and running-back" gear, in some cases set in motion by two winch handles, one at each side, on a cross shaft, and in some cases by a single winch handle on a spindle projecting from the rear of the rear transom. In both instances the same arrangement serves either to traverse the platform or to run the carriage back, means being provided to disconnect the part acting immediately on the trucks, as desired.

The following are the parts of the gear, with handles at the side, for a casemate platform, namely:—

Two bevel pinions, A, A, Plate XXXVI, of metal, with 17 teeth each, and attached, one to each hind truck, by two screws. (Plate XXXVI).

Two truck shafts B, B, of wrought iron, 2½″ in diameter.

Two bevel pinions, C, C, of cast iron, each with 15 teeth, one for the outer end of each truck shaft; secured by key.

Two mitre pinions D, D, of cast iron, each with 18 teeth, one for the inner end of each truck shaft, secured by key.

One longitudinal shaft E, of wrought iron, 2½″ in diameter, with collar and screw to secure it. It has long feathers in front to receive the clutch pinion, and short in rear for the spur wheel.

One clutch mitre pinion F, of metal, 18 teeth, with slots to fit feathers on longitudinal shaft.

One iron lever for clutch, with pivoting bolt and key, and also keep pin with chain.

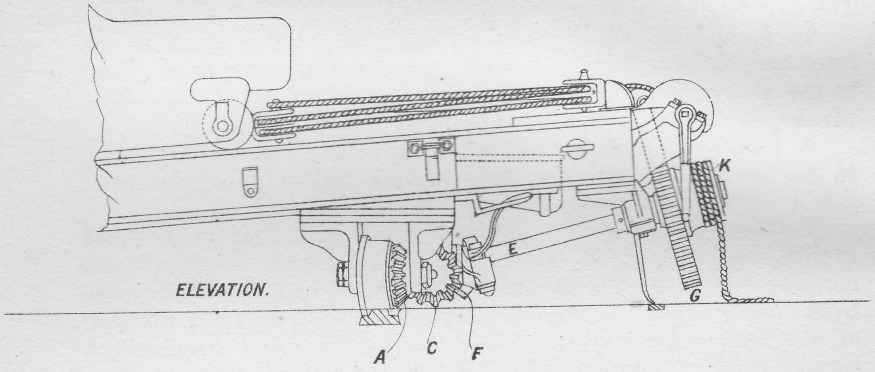
One spur wheel G, of cast iron, 62 teeth, with slot to fit feather on the longitudinal shaft.

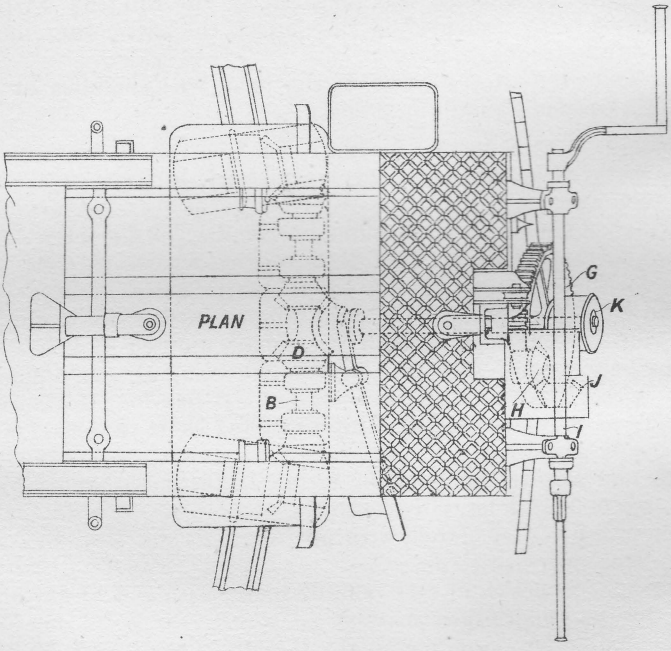
One double pinion of metal, H, 10 teeth on spur part, 19 teeth on bevel part, with collar and pin to secure it.

* They have been 1″ in diameter, but one hole of such is to be plugged up.

# TRAVERSING GEAR.

## FOR 9 IN. CASEMATE PLATFORM.




DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN

One cross shaft, of wrought iron, 2″ in diameter, with two collars with screws to secure, and two winch handles to work it.

One bevel pinion of cast iron, J, 19 teeth, for cross shaft, with key to secure it.

One cast-iron bollard K, for rear end of longitudinal shaft, with two keys to secure it.

One iron block, with two sheaves, and tee shank.

One metal shell, with one sheaf, secured by pin and key.

The truck shafts are held each in a cast-iron bracket with two metal bearings bolted under the rear truck plate. Each metal bearing is made in two parts, an upper and an under, the latter part being held in the bracket by a cap with two screws, so that by simply removing the cap the shaft is released from its bearing; the latter is provided with a lubricating hole. The longitudinal shaft is held in similar bearings and brackets, one bolted to the rear truck plate between the brackets of the truck shafts, and the other under the rear bottom plate. The collar with screw secures the shaft in front of the rear bracket, the clutch slides upon the front of the shaft, the spur wheel is placed immediately behind its rear bracket, and the bollard upon the rear end. The clutch lever is pivoted to a small bracket bolted to the left truck shaft bracket. This lever is fork-shaped at the end, each arm with a stud upon it, which lies in a groove round the clutch, so that when the lever is moved to the front or rear it will carry the clutch with it, but at the same time it will not interfere with the clutch revolving with its shaft. When the clutch pinion is thrown forward into gear with the mitre pinions of the truck shafts and the spur wheel on the longitudinal shaft made to revolve, the trucks must move, the bevel pinions on the other ends of the truck shaft being in gear with the truck pinions. If, however, the clutch pinion be thrown back out of gear with the mitre pinions of the truck shafts, though the spur wheel be moved the trucks will not be affected. The lever is retained in either position required by its keep-pin, which fits into a hole in a guide plate under the left of the platform.

The double pinion fits upon a spindle bolted upon the rear transom, its spur portion gearing into the spur wheel of the longitudinal shaft, and its bevel portion into the bevel pinion of the cross shaft, which is supported in two similar brackets to those of the other shafts bolted to the rear transom. The clutch pinion being in gear, turning the winch handles from rear to front will traverse the platform to the right, and turning them from front to rear to the left. The gain of power in traversing, neglecting friction, is 21·5 to 1.

Upon the top of the rear transom a bracket of wrought-iron is bolted, to which the double block is attached and to the right the shell of the single block in such a position as to lead the fall to the bollard. The clutch pinion being out of gear, and the fall passed round the bollard and held, when the winch handles are turned from rear to

front, the carriage, being on its rollers, will be run back. The gain of power is 22 to 1, exclusive of sheaves, and 110 to 1 inclusive, friction neglected. The exposed parts of the gear are protected by a cover.

For future manufacture it is approved that the winch handles shall work within the length of the platform. This is arranged as follows:—The winch handles are on short shafts, which pass through the sides of the platform, and have pinions on their inner ends, these gear into intermediate pinions also on short shafts, and these latter into pinions on the ends of a long shaft which lies across the platform under the buffer. The intermediate short shaft is connected by mitre gear with a longitudinal shaft held in a bearing, bolted over the rear transom, and which has a pinion on its rear extremity which turns the spur wheel on the bollard spindle. L. of C., § 3847.

If the gear is worked by one handle at the rear instead of two side handles, the parts are the same as before, except that there is no cross shaft, with pinion, &c., nor double pinion, and instead of the latter to drive the spur wheel there is a simple spur pinion of cast iron with ten teeth. This latter is keyed in the usual manner on its spindle, which is supported in two metal bearings, attached to the rear transom. The winch handle, which is bent to clear the bollard, fits upon the spindle. The gain in power in traversing, is 21·5 to 1. Running back, exclusive of the sheaves, 22 to 1, *i.e.* in both cases the same as with handles at side.

Except the bearing surfaces the whole of the gear receives two coats of Pulford's black.

### 9″ R.M.L. of 12 Tons Casemate Platform, Elswick Pattern.

9″ R.M.L. of 12 tons casemate platform, Elswick pattern. (See L. of C., § 1584, for illustration.)

Construction.

This platform is one which was specially constructed for the 9″ Elswick pattern carriages; its sides of girder iron 12″ instead of 10″ deep as in the service pattern; they are bent round to meet in front, as in the latter platform, but connected in a somewhat different manner throughout their length. The chief peculiarity of the platform is that it has but three trucks, one in front, and two in rear. The front truck is of larger diameter than the others, and is placed between the breast of the platform and the front transom at right angles to the longitudinal axis of the platform, and projecting through the bottom plate. The flange of each rear truck is bolted directly to the girder side.

All the platforms of this pattern have been fitted with the Elswick compressor, but neither the bars nor the tripper are interchangeable with the same fitments of the service pattern platform, and the latter is placed on the left side.

They were not fitted with gear.

Some of the platforms have been converted to dwarf "D" pivot, 2″ higher than the service pattern. Weight, 108½ cwt.; tonnage, 8·406 tons.

Others have been converted to dwarf "A" pivot. Weight, 99 cwt.; tonnage, 7·735 tons.

## 9″ R.M.L. of 12 Tons Dwarf Platform "A" Pivot. Mark I.

9″ R.M.L. of 12 tons dwarf platform, "A" pivot, Mark I. R.C.D. photo-lithograph, 130. (Plate XXXVII.)

The 9″ dwarf platform "A" pivot is of similar construction to the 7″ dwarf A pivot, taking the same flanges and trucks as the latter, but having the fittings for the compressor or buffer already mentioned in the description of the 9″ casemate platform, as peculiar to the 9″.

No traversing gear with side handles has yet been made for this platform.

The traversing gear with one handle at the rear is on the same plan as the gear for the casemate platform, the pivot being the "A" in both cases, but the large wheel *a*, Plate XXXVII, on the longitudinal shaft is a bevel instead of a spur wheel, and both it and the pinion *b*, which works it, are placed to the front instead of the rear of the bracket bearing of the shaft, This is done on account of the different arrangement of the running-back gear. In order to get greater gain of power in this the bollard has a bevel wheel *c* fixed to it, and is placed upon a spindle (that of the pinion working the large wheel) above the longitudinal shaft instead of on it, while a pinion *d* upon the extremity of the latter gears into its wheel, thus turning it as the shaft turns.

The parts of the gear are as follows :—

Two bevel wheels of cast iron, *e*, 42 teeth, one secured to each hind truck by four screws.

Two truck shafts of wrought-iron, 2½″ diameter, each with collar and key to secure it.

Two bevel pinions *f*, of cast iron, 14 teeth, one for the outer end of each truck shaft, with key to secure it.

Two bevel wheels *g*, of cast iron, 38 teeth, one for the inner end of each truck shaft, secured by key.

One longitudinal shaft of wrought-iron, 2½″ in diameter, with collar and key.

One clutch pinion *h*, of metal, 18 teeth, with slots to fit feathers on front of longitudinal shaft.

One lever of wrought-iron for clutch, with pivot pin and key, and also keep pin with chain.

One bevel wheel of cast iron *a*, 48 teeth, with slot to fit over feather on longitudinal shaft.

One spindle of wrought iron, 2½″ in diameter, with collar and key to secure it, and winch handle to work it by.

One bevel pinion of cast iron *b*, 12 teeth, for inner end of spindle, with key to secure it.

One bevel pinion of cast iron *d*, 13 teeth, for rear end of longitudinal shaft, with key to secure it.

One cast-iron bollard, metal bouched.

One bevel wheel *c*, of cast iron, metal bouched, 32 teeth, attached to bollard.

One movable block with two sheaves.

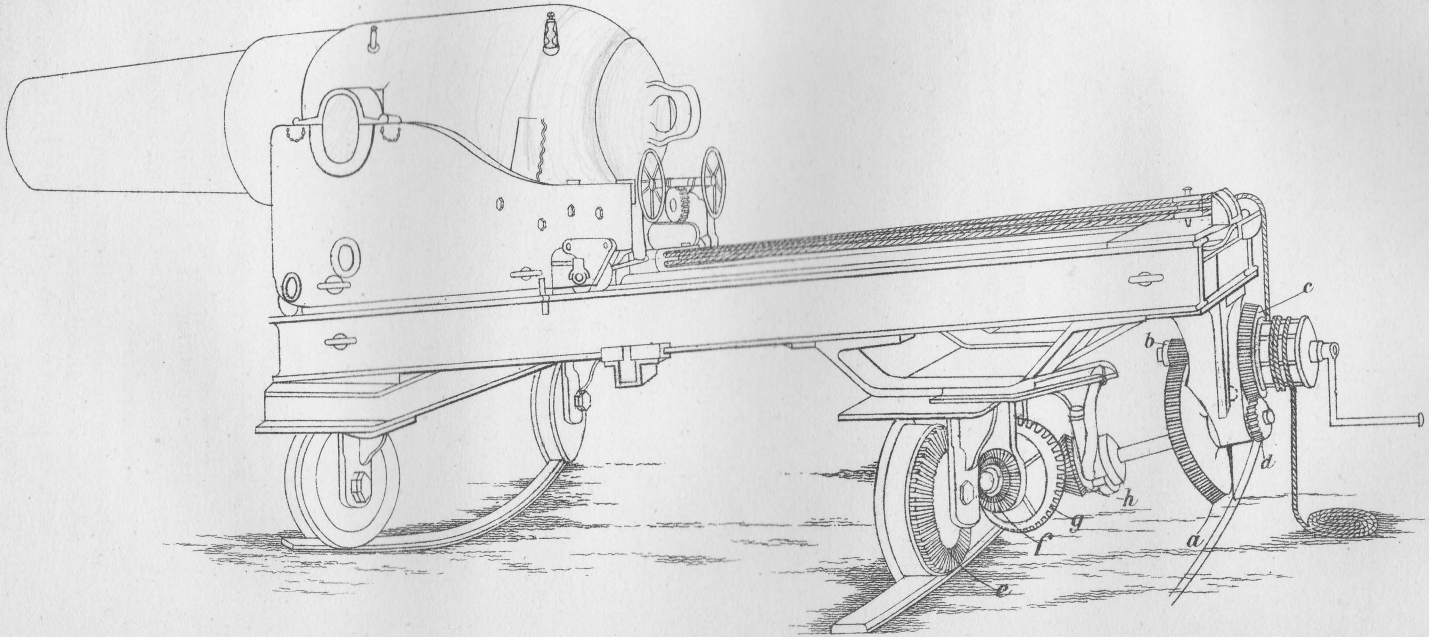
One fixed shell with one sheaf.

Gain of power in traversing, 35 : 1 ; in running back, 32 : 1.

The truck shafts are supported in three brackets beneath the

# 9 INCH 12 TON Wt IRON CARRIAGE AND DWARF PLATFORM.

## (A PIVOT.)




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12446.

DANGERFIELD. LITH 22. BEDFORD St COVENT GARDEN.

rear truck plate, the centre bracket also receiving the front end of the longitudinal shaft. The bracket supporting the rear end of the latter is bolted to the rear bottom plate, and also supports the spindle of the pinion and bollard.

## 9″ R.M.L. of 12 Tons, Dwarf Platform "C" Pivot. Mark I.

9″ R.M.L. of 12 tons dwarf platform, C pivot. Mark I.

The platform is similar to the 7″ dwarf "C," except in the buffer, &c., as before.

Those first made were fitted with traversing gear worked by handles at the side fitting on a cross shaft in rear of the rear transom, as in the casemate platform; those of later manufacture have the cross shaft passing through the sides nearer to the centre. The first mentioned are only used for emplacements not requiring more than 150° of training; the last named, which are known as "C," "central," for emplacements requiring a larger angle of training. The arrangement of the gear is the same in both cases, except in the first motion.

(Plate XXXVIII.)

The pivot of the platform being in the centre, and the front and rear trucks the same size, the trucks put in gear are a front and a rear truck upon the same side. These are set in motion by means of pinions on a long shaft, an intermediate pinion having, from the position of the rear truck, to be used between it and the pinion of the shaft. The long shaft has a pinion upon its rear extremity for the clutch to gear into. The latter is placed above the pinion, upon the shaft which carries the large spur wheel and the bollard, in the same manner as they are carried in the casemate platform, except that the spur wheel goes to the front of the supporting bracket. The spur wheel is worked in the usual manner by a pinion, the latter being set in motion by the cross shaft and two intermediate bevel pinions.

The parts of the gear are as follows:—

Two cast-iron bevel wheels A, A, Plate XXXVIII, 40 teeth, one attached by four screws to the left front truck, the other in the same way to the left rear truck.

One truck spindle P, of wrought-iron, 2″ in diameter, with collar and pin to secure it on the inner end, and collar and hexagonal nut and pin on the outer end.

One cast-iron double pinion B, metal bouched, 18 teeth on each part to fit on truck spindle and gear in truck wheel.

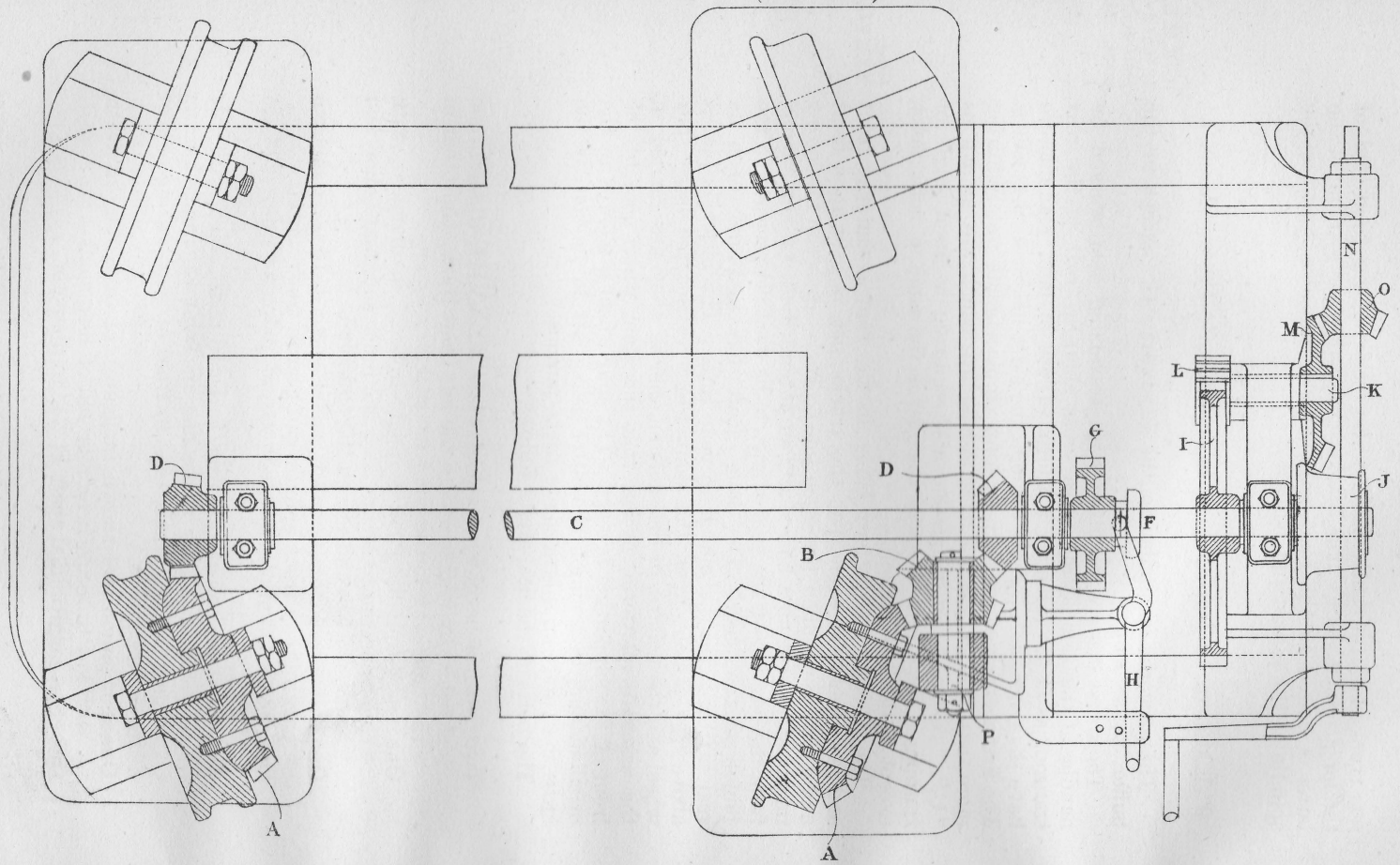
One long longitudinal shaft C, of wrought-iron, $2\frac{3}{4}$″ in diameter.

Two bevel pinions of cast iron, D, D, 18 teeth, each with key to secure it on long shaft, one in front of front bearing to gear in front truck, one in front of rear bearing to gear in double pinion.

One spur pinion (not shown in figure), of cast iron, 22 teeth, with key to secure it on rear end of long shaft.

One short longitudinal shaft F, $2\frac{1}{2}$″ in diameter.

# TRAVERSING GEAR FOR 9" (C PIVOT) PLATFORM.




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DANGERFIELD LITH 22 BEDFORD ST COVENT GARDEN.

One clutch spur pinion G, of cast iron, metal bouched, 23 teeth, with slots to fit long feathers on front of last named shaft.

One clutch lever H, of wrought-iron, with pivot bolt aud pin, and also securing pin with chain.

One cast-iron spur wheel I, 62 teeth, with key to secure it on last named shaft in front of rear bearing.

One cast-iron bollard J, with two keys to secure it on same shaft in rear of bearing.

One spindle K, of wrought-iron, $2\frac{1}{4}''$ in diameter.

One spur pinion L, of cast iron, 13 teeth, with key to secure it on front of spindle.

One bevel pinion M, of cast iron, 35 teeth, with key to secure it on rear of spindle.

One cross shaft N, of wrought iron, 2″ in diameter, with two collars, with screws to secure it, and two winch handles to work it.

One bevel pinion of cast iron O, 15 teeth, with key to secure it on cross shaft.

One movable block, with two sheaves.

One fixed shell, with one sheaf.

The central gear is similar to that of the 11″, Plate XLII, page 238, but without the spur wheel and pinion in the first motion. The wheels and pinions are the same as just described for the rear arrangement, so far as the spur pinion, L, into which a spur pinion of 13 teeth, upon the rear of a short longitudinal shaft, gears. This shaft serves to carry the motion from the centre of the platform, having upon its front extremity a bevel wheel, 27 teeth, which the bevel pinion, 15, of a cross shaft drives, the latter passing through the sides of the platform, and having a winch handle on each end. The platform, fitted with central gear, has no wooden side step, but on each side an iron one.

The long longitudinal shaft is supported under the left of the platform in three cast-iron brackets of the usual description; one bolted to the front truck plate, one to the pivot plate, and one to the rear truck plate, and to a stay of plate strengthened by tee iron which is riveted across the platform to the knee stays. The truck, spindle is supported in a bracket bolted also to this stay and to the rear truck plate, while to the spindle bracket a smaller one for the pivot of the clutch lever is attached, The short longitudinal shaft is held in the rear bracket of the long shaft, and in a bracket bolted to the rear bottom plate, the latter bracket also receives the spindle of the spur wheel pinion. The cross shaft is held as usual in two brackets projecting from the rear transom.

§ 4392. It has been approved to lengthen the winch handle shaft, in platforms fitted with central gear, to enable the winch handle to clear the side arms on the right side of the platform.

## 9″ R.M.L. 12 tons Dwarf Platform "C" Pivot, 7′ Parapet.

With derrick, loading stage, and rear traversing gear for sunken way.

This platform is generally similar in construction and gear to the ordinary "C" pivot platform with rear gear previously described, the only difference being that it is fitted with a loading stage and two derricks, and that the traversing gear is arranged to be worked from the sunken way.

In the traversing gear the cross winch handle spindle N, see Plate XXXVIII, with its bevel pinion O is removed, also the short longitudinal second motion spindle with the wheel K. The pinion L is retained on the new second motion spindle.

The following additional gear is required :—

Winch handle spindle of W.I. 2″ diameter, with collar and screw.
Pinion for spindle of M.C.I. 12 teeth 4·75″ diameter, second motion spindle of W.I. 2″ diameter, with collar and screw.
Wheel for spindle of M.C.I. 25 teeth, 9·94″ diameter.
Bracket C.I. with W.I. stay supporting winch handle and second motion spindles.
Clutch lever. (The handle is straightened and shortened).
Bracket securing clutch lever handle of C.I. with W.I. stay.

The C.I. bracket is bolted beneath the rear transom of the platform to the right of the bracket supporting the bollard spindle. The bracket is connected by the W.I. stay with the rear of the rear truck plate. The winch handle and second motion spindles are supported in double metal bushed bearings in the lower part of the bracket and are secured each by a collar attached by a screw. The rear end of the first spindle takes the service winch handle, the pinion fits on the spindle between the bearings and gears with the wheel on the second motion spindle. The original second motion pinion fits on the front end of the latter spindle and gears with the wheel on the bollard spindle.

Loading derrick.

A malleable C.I. socket is bolted to the front of the platform at each side. A W.I. derrick post revolves in metal bushed bearings in this socket; it is supported on 29 metal balls ·625″ diameter in a groove formed in the top of the socket, a corresponding groove in the post fitting over them. A metal band, attached by six screws to the post, covers the joint. There is an oil channel formed in the post for lubricating the upper bearing.

A jib is hinged to the derrick post. It consists of two curved side plates of wrought iron ·3125″ thick, connected by distance studs, and at the top by a pin, ·125″ diameter, which takes the hook of the upper block of the loading tackle. At their lower ends the sides are strengthened by stiffening plates, and are formed each with an eye, through which a pin passes connecting the jib to a loop formed on the derrick post. The pin is secured by a collar and steel pin. The jib is kept in position by a pawl, which pivots on a pin at the top of the post and engages one of the studs connecting the side plates. The pawl is formed with a handle,

and the pawl pin is connected with the side plate of the jib by a collar and chain.

A cleat is riveted to each side plate, above the top of the post.

Loading stage.

A bent W.I. girder is bolted to each side of the platform at the front, and projects three feet beyond it. A teak flooring for the loading numbers to stand on, 5′ × 3′ rounded off at the front is supported on the girders. Steps leading to the floor are fixed to each girder, consisting on each side of two W.I. side plates connected by two angle iron steps boarded over, and fitted with stanchions and handrail. The steps on each side are connected by diagonal stays of wrought iron. A handrail runs along the front of the stage and connects the upper stanchions on each side.

## 9″ R.M.L. of 12 Tons, Dwarf Platform "D" Pivot. Mark I.

9″ R.M.L. of 12 tons dwarf platform, D. pivot. Mark I. (See R.C.D. photo-litho-graph, 61H).

This platform is similar to the 7″ dwarf "D," except in the buffer, &c., before mentioned.

It has only been fitted with traversing gear set in motion by handles at the side.

The pivot being to the rear of the platform, the front trucks are placed in gear and are driven by means of a long shaft, which has a clutch upon its rear extremity. In prolongation of the long shaft and to the rear of it is the shaft carrying the spur wheel, this has a fixed clutch upon its front extemity, into which the sliding clutch can gear, so uniting the shafts. The spur wheel is driven in the usual way, but the cross shaft is placed under the sides of the platform instead of to the rear of the rear transom.

The parts of the gear are as follows :—

(Plate XXXIX).

Two cast-iron bevel wheels A, A, Plate XXXIX, 34 teeth, one attached to each front truck by four screws.

One truck shaft D, of wrought iron, $2\frac{1}{2}$″ in diameter, with collar and screw to secure it on the right.

One bevel pinion of cast-iron C, 32 teeth, for left extremity of truck shaft, with key to secure it.

One mitre pinion F, of cast-iron, 38 teeth, with key to secure on truck shaft to the left of right bearing.

One double pinion G, of cast-iron, metal bouched, 32 teeth on part which gears in truck, 38 on the other portion.

One long shaft J, of wrought iron, $2\frac{3}{4}$″ in diameter.

One bevel pinion H, of cast iron, 16 teeth, with key to secure it upon front of long shaft.

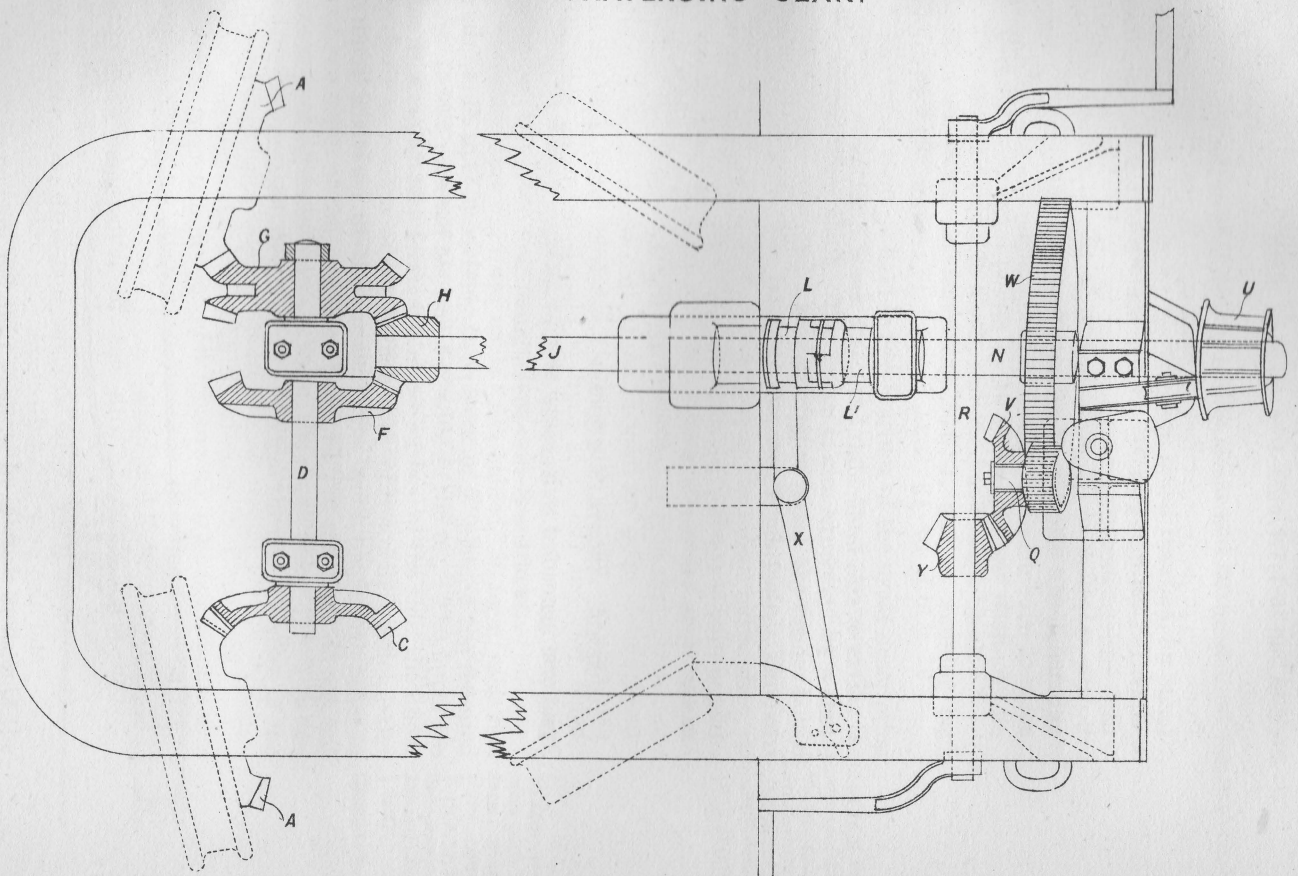
One metal clutch L, with slots to fit feathers on rear of long shaft.

One clutch lever X, of wrought iron, with pivot pin and key, and also keep pin with chain.

One short shaft N, of wrought iron, $2\frac{3}{4}$″ in diameter.

One clutch L′, of cast iron with key to secure it on front of short shaft.

# 9 IN "D" DWARF TRAVERSING GEAR.




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DANGERFIELD LITH. 22 BEDFORD ST COVENT GARDEN.

One spur wheel W, of cast-iron, 65 teeth, with key to secure on short shaft, between its bearings.
One cast-iron bollard U, with two keys for rear end of short shaft.
One wrought-iron spindle Q, with collar and hexagonal nut for each end.
One double pinion V, of cast-iron, metal bouched, for spindle, 12 teeth on spur portion to drive spur wheel, 27 teeth on bevel portion.
One cross shaft R, of wrought-iron, 2″ in diameter, with two collars with screws to secure it, and two winch handles to work it.
One cast-iron bevel pinion Y, 15 teeth, for cross shaft.
One moveable double block, and one fixed single block.
Gain of power in traversing 36·6 : 1, and in running back 34·6 : 1.

The truck shaft is held in two bearings of the usual description bolted under the front truck plate, the right hand also receiving the point of the long shaft. The latter is also supported by a centre bearing of cast-iron and a rear bearing of metal, the former bolted to the pivot plate, the latter to the rear truck plate. The front bearing of the short shaft is bolted upon the sabicu block plate, its rear bearing, which also takes the spindle, to the rear bottom plate. The brackets for the cross shaft are bolted, one under each side and the rear bottom plate, projecting inwards.

## 10″ R.M.L. of 18 Tons, Casemate Platform. Mark I.

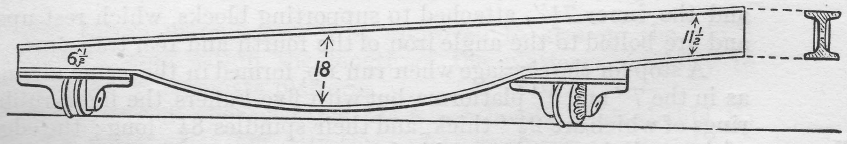
10″ R.M.L. of 18 tons casemate platform, Mark I (low). See R.C.D. photolithographs, 133 and 133A.) § 1937.

Construction.

This platform consists of two sides, five transoms, two truck plates, one top plate, four flanged feet, and four trucks.

The sides (see Fig.) are made "fish-bellied" in form, each side being "built up," by riveting two pieces of $\frac{3}{4}$″ plate of the required shape to two pieces of tee iron $6\frac{3}{4}$″ wide in the tee. The upper tee iron is straight and forms the upper surface of the side, the under one bent to correspond to the fish belly of the plates, which latter lie upon the webs of the former. The webs touch each other in front, the depth of the side there being $6\frac{1}{2}$″, in rear they do not, but have a packing piece between them, the depth being $11\frac{1}{2}$″ : in the middle the greatest depth is 18″. When the upper surface of the

Fig. 69.




side stands at 4°, the ends are vertical : the interior surfaces of the parts are painted with Pulford's black, before being riveted together, and when complete the side is planed in the usual manner.

The front transom is of 1″ plate, with a piece of angle iron riveted along the upper edge and another piece along the lower edge.

The second transom is of 1½″ plate, riveted to a three-sided frame of angle iron: the plate had a circular hole in the centre for the end of the piston rod to enter when the carriage is run up.

The third and fourth transoms are each of 1″ plate riveted on three sides to a frame of angle iron.

The fifth transom is also of 1″ plate, with angle iron riveted all round except where a space is left at the upper edge to admit of the cap of the buffer, when the transom is in position, bearing against the plate.

The top plate and truck plates are each 1″ in thickness.

The flanged feet, both front and rear, are formed in the same manner as the front in the 7″ and 9″ casemate platforms, that is, with the flanges unconnected.

In some platforms, in order to admit of a greater angle of traverse, the front trucks have been moved closer to each other, and their feet made of angle iron in one piece. The front trucks are 10″ in diameter and the rear 13″, and the former are coned to the pivot.

§ 4029. Since March 1882, both front and rear trucks have been made of steel with bushes of P.B.

The front transom, its angle iron being on the inner side, is secured between the front extremities of the sides by iron knees which are bolted to the sides and to itself. The second transom is slightly let into the sides, 1′ from the front. The top plate lies over the front transom and sides and upon the angle iron of the second transom, and is bolted to all. The third and fourth transoms rest upon the lower tees of the sides, and are bolted to the latter, respectively at 4′ 8″ and 8′ 4″ from the front. The fifth or rear transom is let into and bolted to the sides 4¼″ from their rear extremities; this, as well as all the other transoms, stand vertical when the sides of the platform are at the correct slope. The front truck plate is bolted beneath the front of the sides, and the rear truck plate 10¼′ more to the rear, angular packing pieces being placed between the latter and the sides. The flanged feet are bolted beneath the truck plates at the correct set to suit the "A" pivot and the trucks secured in them on 3″ axles by double nuts.

The platform has the following fittings, namely,—

Foot planks, two on each side of the buffer, the outer 9″ wide. and the inner 7½″, attached to supporting blocks, which rest upon and are bolted to the angle iron of the fourth and rear transoms.

A stop for the carriage when run up, formed in the same manner as in the 7″ and 9″ platforms, but with five buffers, the india-rubber rings of which are 2½″ thick, and their spindles 8½″ long; the edges

§ 4825. of the angle iron and wood block are now rounded to prevent injury to the fall of the loading tackle. Alternate rings of felt and galvanized iron will in future be substituted for the india-rubber rings of the stops, as in the lower natures of platforms.

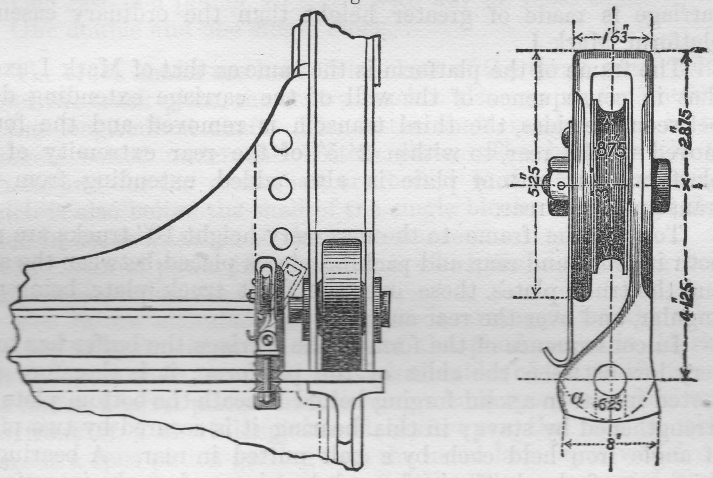
Stops to receive the carriage on recoil, placed 2′ 11½″ from the rear extremities of the side; the spindles of these are 6″ long.

A pointer as in the 9″ platforms.

Eye bolts and staples for the side arm brackets, as in the 7″ and 9″ platforms.

Two snatch blocks for loading tackle are attached to the top plate. Mark II blocks differ from Mark I (see Fig.) in having the bottom of the knuckle (*a*) formed into a stop, to prevent the block falling over and being injured by the carriage when run up.

Fig. 69A.




The fittings for the hydraulic buffer are a front bearing plate of angle iron, which is riveted to the top of the fourth transom, and a rear bearing plate of plate iron riveted to the rear transom. The holding-down bands are the same as those of the 7″ or 9″ platforms, as is also the staple for the spanner. The holes in the piston of the buffer are ·8″ in diameter; its cap, flange, and cover are made of wrought iron.

The traversing and running-back gear, handles at the side, is similar in its parts and working to that of the 9″ casemate platform, but the number of teeth in the spur wheel is 62, in the bevel portion of the double pinion which gears into the pinion of the cross shaft 27, and in the latter pinion 15. The gain of power in traversing is 40 : 1, and in running back, exclusive of the sheaves, 41 : 1.

For future manufacture it is approved to arrange the winch handles to work within the length of the platform, similarly to those of the 9″ casemate platform.

It was at first approved that the winch handle shaft should lie over the girder sides, but only three platforms were so altered.

The traversing and running-back gear, handle at the rear, is similar to the corresponding 9″ gear, but to increase the gain of power, an additional spur wheel and pinion are introduced; these are cast in one and secured upon a spindle by a collar and

hexagonal nut. The driving pinion has 12 teeth and gears in this intermediate wheel, which has 46 teeth; the pinion of the latter has 12 teeth and gears in the spur wheel of the shaft, which wheel has 46 teeth. The bracket of the spindle of the driving pinion is of metal and in two parts, as in the 9″ gear. The gain of power in traversing is 50 : 1 and in running back 52 : 1.

## 10″ R.M.L. OF 18 TONS, CASEMATE PLATFORM. MARK II. (HIGH.)

**10″ R.M.L. of 18 tons, casemate platform, Mark II (high). (Plate XXX.)**

This platform is constructed for the 10″ carriage, Mark II (low), and to make up for the lowness of the brackets of that carriage is made of greater height than the ordinary casemate platform, Mark I.

**Construction.**

**L. of C., § 2513.**

The frame of the platform is the same as that of Mark I, except that in consequence of the well of the carriage extending down between the sides, the third transom is removed and the fourth moved to the rear, to within 2′ 5″ of the rear extremity of the platform. A bottom plate is also added, extending from this transom to the rear.

To raise the frame to the necessary height 18″ trucks are used both in front and rear, and packing pieces placed between the sides and the truck plates. those over the front truck plate being rectangular, and over the rear angular.

**Fittings.**

In consequence of the form of the carriage the buffer has to lie very low between the sides of the platform; it is therefore supported in rear in a solid forging bolted beneath the bottom plate and strengthened by stays; in this bearing it is secured by two pieces of angle iron held each by a bolt nutted in rear. A bearing for the front of the buffer is formed by pieces of angle iron riveted together, and bolted across beneath the sides; upon this the buffer is secured by a band in the usual way. The plug for the buffer is special.

The stops for the carriage when run up, are fixed to the second transom, those for the carriage on recoil to the rear transom but one. The platform has no foot planks.

The traversing and running back gear, which is worked by two side handles, is similar to the casemate platform, Mark I, but the longitudinal shaft instead of lying central is to the left, to clear the buffer, which necessitates the right truck shaft being longer than the left.

The parts are as follows:—

Two cast-iron bevel wheels for hind trucks, 25 teeth.

Two truck shafts, $2\frac{3}{4}$″; the right the longer, and with collar and screw.

One cast-iron bevel pinion, 17 teeth, with key, for right of right truck shaft.

One cast-iron bevel pinion, 27 teeth, with key, for left of right truck shaft.

One cast-iron double pinion, with key, for left shaft, 17 teeth on portion which gears in truck, 27 on that which gears in clutch.

One shaft, $2\frac{1}{2}$″ with collar and screw.
One metal clutch for shaft, 27 teeth.
One spur wheel of cast iron, 65 teeth, with key to secure it on shaft in rear of the rear bracket.
One bollard with two keys for same shaft.
One spindle with collar and hexagonal nut.
One cast-iron double pinion, 13 teeth on spur portion, 27 on bevel portion.
One cross shaft, 2″, with two collars with screws and two winch handles of 17″ radius.
One cast-iron pinion, 15 teeth, with key for cross shaft.
One double and one single block.

The truck shafts are held in brackets of the usual form bolted under the truck plate, the centre bracket also serving for the front of the longitudinal shaft. The latter shaft is also held in two brackets bolted under the bottom plate. The bearings for the spindle and for the cross shaft are bolted to the rear transom, to which is also bolted the shell of the single block: the double block when in use is attached to the same transom.

The gain of power in traversing is 43 : 1, and in running back, without reckoning the sheaves, 32 : 1.

For future manufacture the gear is arranged for the winch handles to work within the length of the platform, as in Mark I, but the cross shaft is carried through the sides of the platform over the buffer, a bevel pinion on it driving a corresponding wheel upon the front of a short longitudinal shaft, upon the rear of which there is a spur pinion gearing into the usual large spur wheel.

The guns in certain forts at Spithead being required to fire over a sill 9″ higher than ordinary, a special pattern has been approved for them, raised 9″ in height by knee stays between the sides and truck plates, and by using 24″ trucks in rear. At the same time the gear is arranged to work within the length of the platform somewhat similarly to that of the platform of ordinary height; but instead of the cross shaft passing through the sides of the platform, the winch handles are carried on two short shafts held in bearings under the sides; on the inner ends of these are spur pinions, into which gear pinions on the ends of a connecting cross shaft lying above the buffer. A few platforms for these works were converted in course of manufacture by having 9″ packing pieces inserted between the sides and the truck plates, the existing trucks being retained.

L. of C., § 3011.

## 10′ R.M.L. of 18 tons, Dwarf Platform, "A" Pivot. Mark I.

This platform is the same as the casemate 10″ Mark I, in general construction, but raised to the requisite height by means of a sabicu block with plate and packing pieces over 18″ trucks in front, and knee stays over 24″ trucks in rear. The flanges of the feet are not connected either in front or rear.

10″ R.M.L. of 18 tons, dwarf platform, "A" pivot. Mark I.

The fittings of the platform are the same as in the casemate,

except that the side step is added on each side, hooked to staples for the purpose. The steps are 9′ 2″ long by 10″ wide.

The traversing and running-back gear with handle at the rear is on a similar plan to that of the 9″ or 10″ casemate; the wheels and pinions are as follows:—

Truck wheels, 35 teeth.
Pinions which gear in the truck wheels, 15.
Clutch, which is of cast iron, metal bouched, 21.
Pinions on the truck shafts in which the clutch gears, 24.
Spur wheel, which is placed to the rear of the shaft bracket, 46.
Spur pinion, 12.
Spur wheel to drive foregoing, 46.
Spur pinion in one with previous wheel, 12.

To form a support for the front brackets for the spindles, a plate is fitted across the platform in front of the rear transom, and strengthened by two pieces of tee iron from itself to the transom.

A few platforms have been fitted with gear set in motion by side handles, similar to that of the 9″ or 10″ casemate gear, handles at the side; it is the same as the preceding in the truck wheels, truck shafts with their pinions and the clutch lever: the spur wheel has 62 teeth, its driving pinion 10, the bevel pinion on the same spindle with the previous 27, and the bevel pinion of the cross shaft 15. The cross shaft instead of projecting to the rear of the platform lies under its sides, so that instead of there being one pinion, a double one between the spur wheel and pinion of the cross shaft, there are two on the same spindle, a spur pinion to gear in the spur wheel, and a bevel pinion to gear in the pinion of the cross shaft.

### 10″ R.M.L. of 18 Tons, Dwarf Platform, "C" Pivot. Mark I.

**10 R.M.L. of 18 tons, dwarf platform, "C" pivot. Mark I.**

This is the same as the dwarf "A," but with knee stays between the sides and truck plates, and 24″ trucks both front and rear. A pivot plate is placed from the third to the fourth transom and bolted to them; in the centre of the plate is a hole for the pivot bolt.

The traversing and running back gear, with which the platform is fitted, is as in the 9″ dwarf C, "rear" or "central." The number of teeth in the wheels and pinions of the rear gear, which is arranged similarly to that of the 9″, are as follows:—

Truck wheels, 35 teeth.
Double pinion, metal bouched, 15 teeth on each part.
Bevel pinions of long shaft, 15.
Spur pinion of long shaft, 27.
Cast-iron clutch, metal bouched, 23.
Spur wheel, 62.
Pinion which drives spur wheel, 11.
Bevel pinion on same spindle, 15.
Bevel pinion of cross shaft, 15.

The central gear, which is arranged like that of the 11″, Plate XLII, page 238, is the same as the previous only so far as the bevel pinions of the long shaft; after which it is as follows:—

Spur pinion of long shaft, 23 teeth.
Clutch, 23.
Bevel wheel on front of same longitudinal shaft as clutch, 35.
Bevel pinion gearing in preceding, 15.
Spur wheel on spindle of latter, 62.
Spur pinion on cross shaft gearing in spur wheel, 12.
The gain of power is 42·8: 1 for traversing or running back.

### 10″ R.M.L. of 18 Tons, Dwarf Platform, "C" Pivot, 7′ Parapet, with Derrick, Loading Stage and Rear Traversing Gear for Sunken Way.

This platform in construction is similar to the preceding, and in gear and fittings is generally similar to the 9″ R.M.L. 7′ parapet, p. 227, with the following slight exceptions:—

The bracket for the clutch lever handle is of wrought iron.

The side plates of the jib of the derrick are connected by a series of stay plates instead of distance studs. An eye is riveted between the plates at the top for the hook of the upper block of the loading tackle, and a pin for the pawl of the derrick post below the cleats.

A W.I. supporting bracket is attached by two screws to the lower part of the derrick post socket. This bracket supports a W.I. shackle, with pin for the snatch block of the loading tackle.

The girders supporting the loading stage are bolted to the front truck plate. The floor is wider, 5′ 10·5″ by 4′ 7″. There is no front handrail, and the stays connecting the steps on each side are of steel plate.

The pinion on the winch handle spindle is of M.C.I., 11 teeth, 4·376″ diameter. The wheel on the second motion spindle is of M.C.I., 44 teeth, 17·507″ diameter.

### 10″ R.M.L. of 18 Tons, Dwarf Platform, "D" Pivot. Mark I.

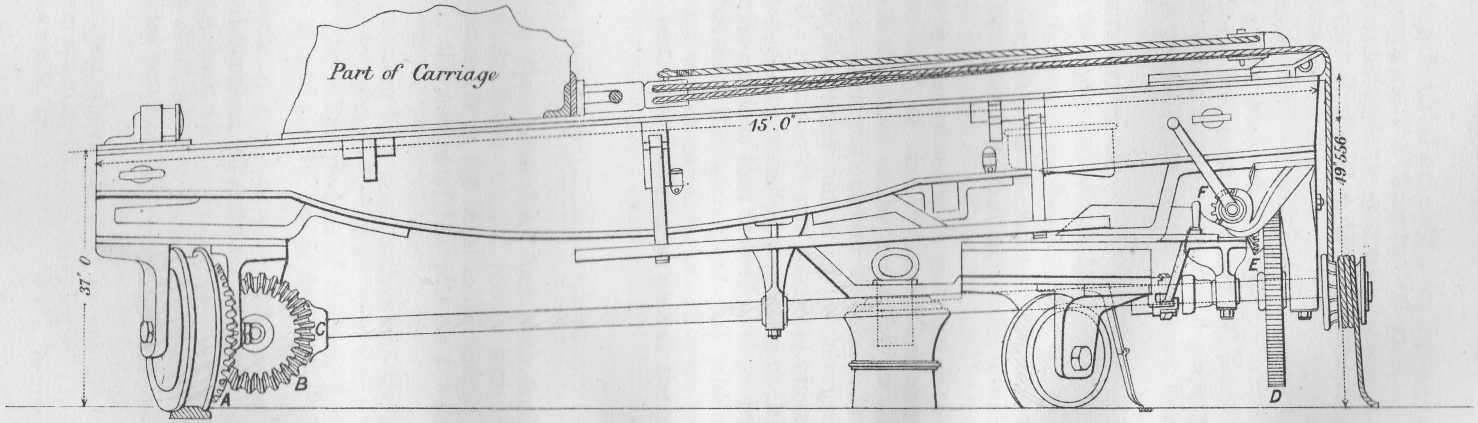
10″ R.M.L. of 18 tons, dwarf platform. "D" pivot Mark I. Plate XL. (See also R.C.D. photo-lithographs, 136 and 136A.)

This is the same as the "C" pivot platform, except that it has 18″ trucks in rear and a sabicu block with plate and angular packing pieces between the sides and the rear truck plate, and to suit the position of the pivot, the pivot plate placed from the fourth transom to the block.

The traversing and running-back gear is the same as in the 9″ D platform, except that the number of teeth in the different wheels and pinions varies, viz.:—

Truck wheels, A, 35 teeth.
Bevel pinion B, to gear in right truck wheel, 30.
Mitre pinion of truck shaft, 30.
Double pinion, metal bouched, 30 on each part.
Mitre pinion C, of long shaft, 16.
Spur wheel, D, 62.

# TRAVERSING GEAR FOR 10IN. DWARF PLATFORM D "PIVOT."




To face page 235.

12448.

Dangerfield, Lith. 22, Bedford St. Covent Garden.

Double pinion E, 12 teeth in spur part, 35 in bevel part.
Pinion F, of cross shaft, 15.
Gain of power in traversing, 39·25 : 1; in running back, 42·75 : 1.
The longitudinal shaft is also carried on the left side.

## 10″ R.M.L. of 18 Tons, Small Port Platform. Mark I.

10″ R.M.L. of 18 tons, small port platform. Mark I. § 3182.

This is the same in general construction as the 10″ casemate platform, Mark I, but is raised 6″ by the introduction of packing pieces, the front trucks also being made 13″ in diameter. The traversing and running back gear is also the same.

The hydraulic lift of the carriage being central necessitates the use of two hydraulic buffers on the platform, one at each side; they are of the service pattern, with 1″ holes in their pistons.

## 11″ or 12″ R.M.L. of 25 Tons, Casemate Platform. Mark I.

11″ or 12″ R.M.L. of 25 tons, casemate platform. Mark I. Plate XLI. (See also R.C.D. photo-lithographs, 137 and 137A).

The construction of this platform is the same as that of the 10″ casemate, Mark I, but underneath the ends of the sides and rear transom a bottom plate is bolted, a piece of angle iron being riveted along the back of the transom for attachment to the latter, and a diagonal stay with two arms is placed between the third and fourth transoms. The greatest depth of the side is 20″, its depth in rear 11½″, and in front 8¼″, while the width of the tees is 6¾″.

The brackets for the side arms and spindles of the buffer stops are the same as in the 10″ platform.

L. of C., § 3544, 4029.

The trucks are now made of steel, with bushes of P.B., the axles are stronger, and are secured by cotters and keys instead of nuts, so as to avoid their being weakened by the threads. The edges of the angle iron and wood blocks of the front buffer stops are rounded, as in the 10″ platforms.

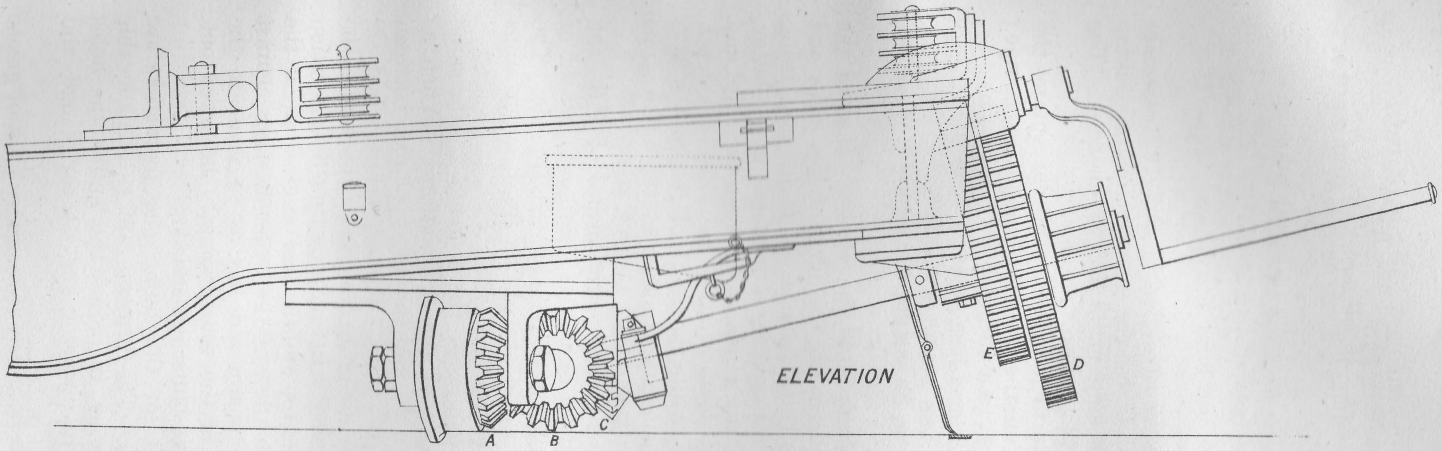
If fitted for the Elswick compressor, the fitments are the same and interchangeable with those of the 9″ platform. When so fitted, the footplanks are 15″ wide, and the short planks between the fifth and sixth transom 6″ wide. These platforms had six transoms, of which, when they are altered to take the buffer, the fourth from the front is removed. In addition to this alteration and removing the bars, &c., the top and bottom angle iron of the rear transom have to be cut to allow of the buffer bearing against the plate, a hole to admit the piston rod has to be made in the second transom, and the top of the fourth slightly hollowed out, when the usual fitments for the buffer are added.

If the platform is fitted for the buffer, the footplanks are 10½″ wide, two on each side. The fitments are interchangeable with those of the 10″ platforms, including the buffer, the holes (four) in its piston being ·8″ in diameter, and its cap, flange, and cover of wrought iron.

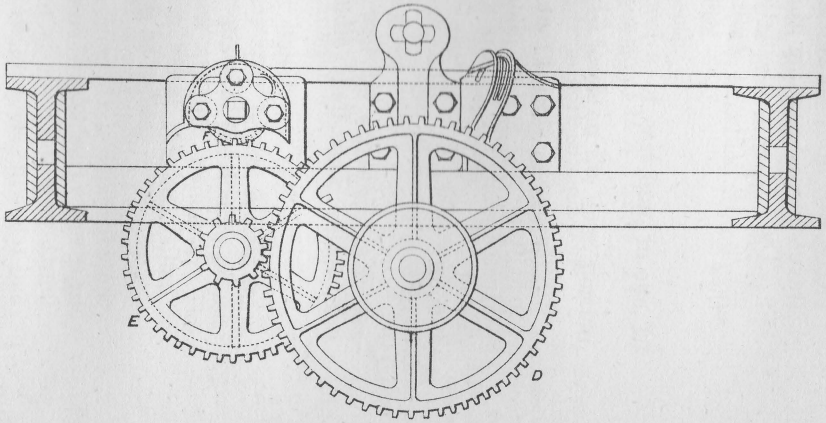
§ 3798.

A staple plate to secure a grease box (to contain 3 lbs. of grease

# REAR TRAVERSING GEAR FOR 11.IN: CASEMATE PLATFORM.




ELEVATION




REAR ELEVATION

To face page 236.

DANGERFIELD, LITH. 22. BEDFORD ST. COVENT GARDEN.

for lubricating the bases of projectiles) is now added to all platforms for R.M.L. guns 11″ and upwards. The plate is attached on the left side near the front.

Before the introduction of running back gear, this platform was fitted with two bollards, one on either end of the rear transom.

The traversing and running back gear, handles at the side, is similar to the gear of the 10″ casemate, Mark I, but to increase the gain of power an additional pinion and wheel cast in one, are introduced between the spur wheel and the driving pinion on the cross shaft.

The wheels and pinions are as follows :—

Two metal bevel wheels A, 17 teeth, for hind trucks.
Two cast-iron pinions B, 17 teeth, to gear in truck wheels.
Two mitre pinions, cast iron, 16 teeth, in which clutch gears.
One metal clutch pinion C, 16 teeth.
One spur wheel D, cast iron, 62 teeth.
One intermediate pinion and wheel E, of cast iron, in one, 13 teeth on the pinion, 46 on the wheel.
One double pinion of cast iron, 13 teeth on the spur portion, 19 teeth on the bevel portion.
One bevel pinion for the cross shaft, 19 teeth, of cast iron.

A treble block is used in this and all natures of 11″ platforms, instead of a double as in the 10″ platform. The shafts, except the cross shaft, which is 2″, are $2\frac{3}{4}$″ in diameter, and the radius of the winch handle is 16″. The gain in power in traversing is 48 : 1, and in running back, 56 : 1.

For future manufacture the gear will be arranged, as in the 9″ casemate, so that the winch handle shall work within the length of the platform.

The gear set in motion by one handle at the rear is the same as the foregoing, except that the spur pinion F, held on a spindle in a metal bracket, takes the place of the double pinion while the cross shaft and its pinion are not required. The spindle of the pinion is supported in a metal bracket bolted to the rear transom. The gain of power is as before.

### 11″ or 12″ R.M.L. of 25 Tons, Dwarf Platform, "A" Pivot. Mark I.

11″ or 12″ R.M.L. of 25 tons, dwarf platform. "A" pivot. Mark I.

The frame of this platform is the same as the last described, and it is raised to the required height in the same manner as the 10″ dwarf A. It has not yet been fitted with traversing and running back gear, but a drawing has been sealed to govern future manufacture, handle at the rear.

### 11″ or 12″ R.M.L. of 25 Tons, Dwarf Platform, "C" Pivot. Mark I.

11″ or 12″ R.M.L. of 25 tons, dwarf platform, "C" pivot.

This platform corresponds to the 10″ dwarf C, and is fitted with traversing and running back gear similar to the latter and the 9″ dwarf C.

Mark I. (See R.C.D. photo-lithograph, 139.)

The wheels and pinions are as follows:—

Truck wheels, A, A, 35 teeth.
Double pinion B, metal bouched, for truck shaft, 15 on each part.
Bevel pinions C, C, of long shaft, 15 each.
Spur pinion D, of long shaft, 32.
Clutch spur pinion, metal bouched, 19 teeth.
Spur wheel, 62.
Spur pinion which drives spur wheel, 11.
Bevel pinion on same spindle as last, 15.
Bevel pinion of cross shaft, 15.

Plate XLII.

When the gear is "central," the longitudinal shaft with its pinions, &c., remaining the same, the remainder of the gear is then as follows:—

Short longitudinal shaft F, with collar and pin.
Metal clutch E, 14 teeth, with lever, to fit on short shaft and gear in spur pinion on end of long shaft.
Bevel wheel G, 35, with key, to fit on front extremity of short shaft.
Spur wheel H, 46.
Bevel pinion J, of metal, 15, on same spindle as previous, to gear in previous bevel wheel G.
Spindle with screw, collar, and nut, for spur wheel.
Cross shaft I, with spur pinion K, 12, to gear in spur wheel.

For driving bollard:—
Spur pinion L, 12, with key on rear of short shaft.
Spur pinion M, 19, with key on bollard spindle to gear in previous.
Gain of power in traversing, 66 : 1; in running back, 47 : 1.

The short longitudinal shaft is supported in two brackets, one attached to the rear transom, and one to the rear truck plate. The spindle of the spur wheel with pinion is held in a bracket bolted to the rear truck plate, and the bollard spindle in a bracket bolted to the transom. The cross shaft passes through metal bearings bolted in the sides of the platform about 6′ from the rear.

§ 4392.

The winch handle shaft has been lengthened to allow the winch handle to clear the side arms of the right side of the platform.

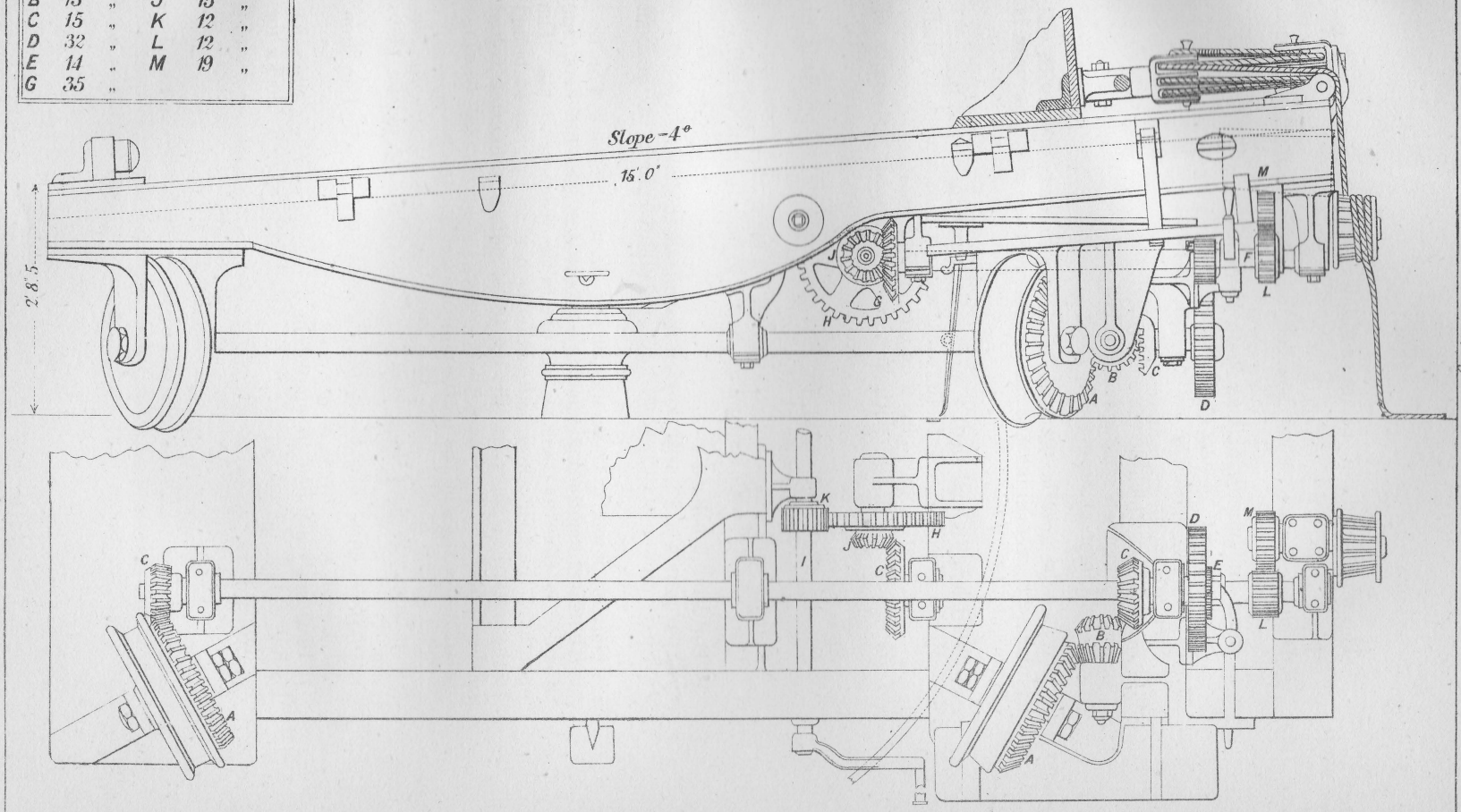
Platform with central gear have a short wood step and an iron step at each side instead of one long wooden one.

Platforms mounted in emplacement having sunken ways for loading stages do not require to be fitted with snatch blocks for loading tackle.

## TRAVERSING GEAR "CENTRAL" (MARK I) FOR II IN DWARF PLATFORM "C" PIVOT.

**TABLE OF WHEELS.**

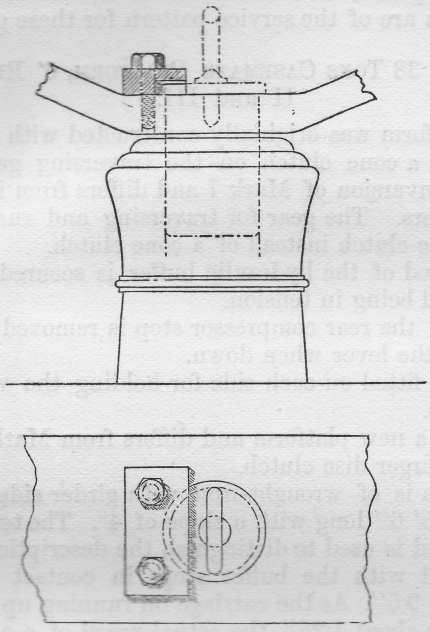
| | | | | | |
|---|---|---|---|---|---|
| A | 35 | teeth | H | 16 | teeth. |
| B | 15 | " | J | 15 | " |
| C | 15 | " | K | 12 | " |
| D | 32 | " | L | 12 | " |
| E | 14 | " | M | 19 | " |
| G | 35 | " | | | |




To face page 238.

DANGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN.

Fig. 70.



It has been approved to attach a clip plate, Fig. 70, to the pivot plate, in front of the pivot plug to prevent the latter being displaced by the concussion of firing. § 4775.

12″ R.M.L. 35 Tons Dwarf Platform "C" Pivot. Mark I.

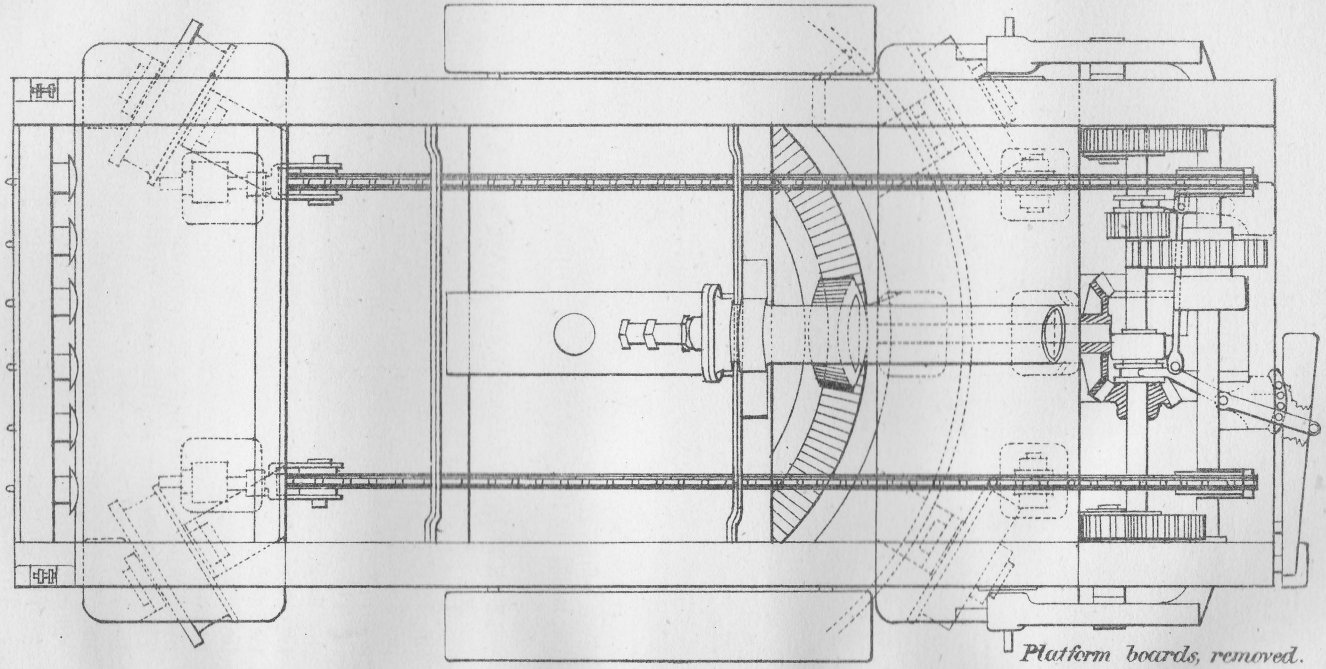
This platform in its construction and gear is similar to that for the 12·5″ R.M.L. gun. It is fitted with a hydraulic buffer in compression, the piston of which has four holes ·65″ diameter; working contents of the buffer, 11½ gallons.

The traversing gear is not fitted with a friction disc clutch, but the bevel and spur pinions, Plate XLIII, on the cross shaft for traversing and running back respectively, are moved themselves by two forked levers pivoted under the rear of the platform. The lever acting on the bevel pinion for traversing, is prolonged and formed into a handle to work at the rear of the platform, and is fitted with a guide and pin to secure it in the position required. The lever acting on the spur pinion is connected with the other lever by a rod, which has a short slot at one end, so that one pinion may be fully out of gear before the edge of the slot, which acts against a stud, causes the lever of the other to move.

The platform is fitted with compressor stop and preventor gear. § 4888.

Three 12·5″ R.M.L. 38 ton guns at Malta are mounted on platforms of the above description which were constructed for 12″ R.M.L. 35 ton guns.

# PLATFORM, DWARF, 12 INCH. 35 TON, MARK I.



*Platform boards, removed.*

DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12453.

Three 12″ R.M.L. 35 ton guns, at Fort Westmoreland, Cork, are mounted on platforms which were constructed for 12·5″ 38 ton guns, and which are of the service pattern for these guns.

### 12·5″ R.M.L. of 38 Tons Casemate Platform, 6′ Recoil. Marks II and III.

§3100. Mark I platform was originally constructed with a compression buffer, and with a cone clutch on the traversing gear. Mark II platform is a conversion of Mark I and differs from it in the following particulars. The gear for traversing and running back is

§ 4112. fitted with a disc clutch instead of a cone clutch.

The piston rod of the hydraulic buffer is secured to the front transom, the rod being in tension.

One plate of the rear compressor stop is removed and a pawl is fitted to secure the lever when down.

Brackets are fitted on each side for holding the winch handles when not in use.

Mark III is a new platform and differs from Mark II in being arranged for a larger disc clutch.

The platform is of wrought-iron, with girder sides, fish-bellied in form; it is 15′ 6″ long with a slope of 4°. The term 6′ recoil is nominal only, and is used to distinguish the description of platform. The actual recoil with the buffer stops in contact only and not compressed is 5′ 9·5″. As the carriage on running up will compress the front buffers about 1·25″, the actual recoil of a carriage should not exceed 5′ 10·75″, when the rear stops will be touched but not compressed.

The sides are connected by five transoms, a front top plate, and a rear bottom plate. Truck plates are fixed under the sides to which the flanges for the trucks are bolted. The front truck plate is bent downwards to clear the hydraulic buffer, and its rear edge strengthened by angle iron. The second transom near the front of the platform is strengthened by a plate, with packing pieces and two knees, the latter riveted to them and the front truck plate. A hole is drilled through the transom and plate for the piston rod of the hydraulic buffer.

The parts of the platform are:—

Two front trucks.
Two rear trucks.
One rear step.
Footboard.
Compressor stop.
Preventor bar.
Front buffer stop.
Rear buffer stop.
Traversing gear.
Running back gear.
Two snatch blocks.
Traversing pointer.

The trucks are of steel, with bushes of gun metal; since

March, 1882, the bushes are of P.B. The front trucks are 13″ in diameter, are coned to suit the pivot and have two flanges. The rear trucks are 18″ diameter, cylindrical, and have a front flange only. The truck axles are of steel 3·75″ diameter each secured by a screwed nut and pin. § 5182.

The traversing and running back gear, Plate LXIV, is worked by the horizontal shaft A, under the rear of the platform, which is set in motion by two winch handles working within the length of the platform. This shaft has two pinions riding loosely upon it, a bevel pinion B for the traversing gear, and a spur pinion C for the running back gear. By means of a double clutch either pinion can be made to revolve with the shaft. For traversing, the bevel pinion is connected with a longitudinal shaft, having on it a pinion D, which gears into a cast iron rack let into the floor of the work. For running back the spur pinion C gears into a spur wheel E on another cross shaft, on each end of which there is a sprocket wheel with teeth that fits into an endless chain. The chains, to which the carriage can be connected, when necessary, by the nipping gear, pass over rollers F, F, carried in adjusting forks at the front of the platform. **Traversing and running back gear.**

A clutch lever N, is pivoted at the rear of the platform, and carries an adjusting nut O, in its front end which is forked. Through this nut passes the screw shaft P, which also passes under the left side of the platform and has a handwheel on its outer extremity. By turning the handwheel, the nut O is moved along the screw, carrying the lever with it, and causing it to put one or other of the clutches into action.

The following are the parts of the traversing and running back gear:—

Two winch handles of W.I. with metal ferule, radius 16″.

Two winch handle shafts of W.I. 2″ in diameter, with feathers.

Two spur pinions H, H, of C. I., 13 teeth, 5·172″ in diameter, for winch handle shaft.

Two brackets for winch handle shaft, one right and one left, each with two 1″ bolts.

Two spur wheels K, K, 2nd motion, of C.I., 60 teeth, 23·873″ diameter.

Two shafts, 2nd motion, of W.I., 2·5″ diameter, each with a collar keep screw and key.

Two spur pinions L, L, 2nd motion, of C.I., 12 teeth, 5·73″ diameter, with two feathers.

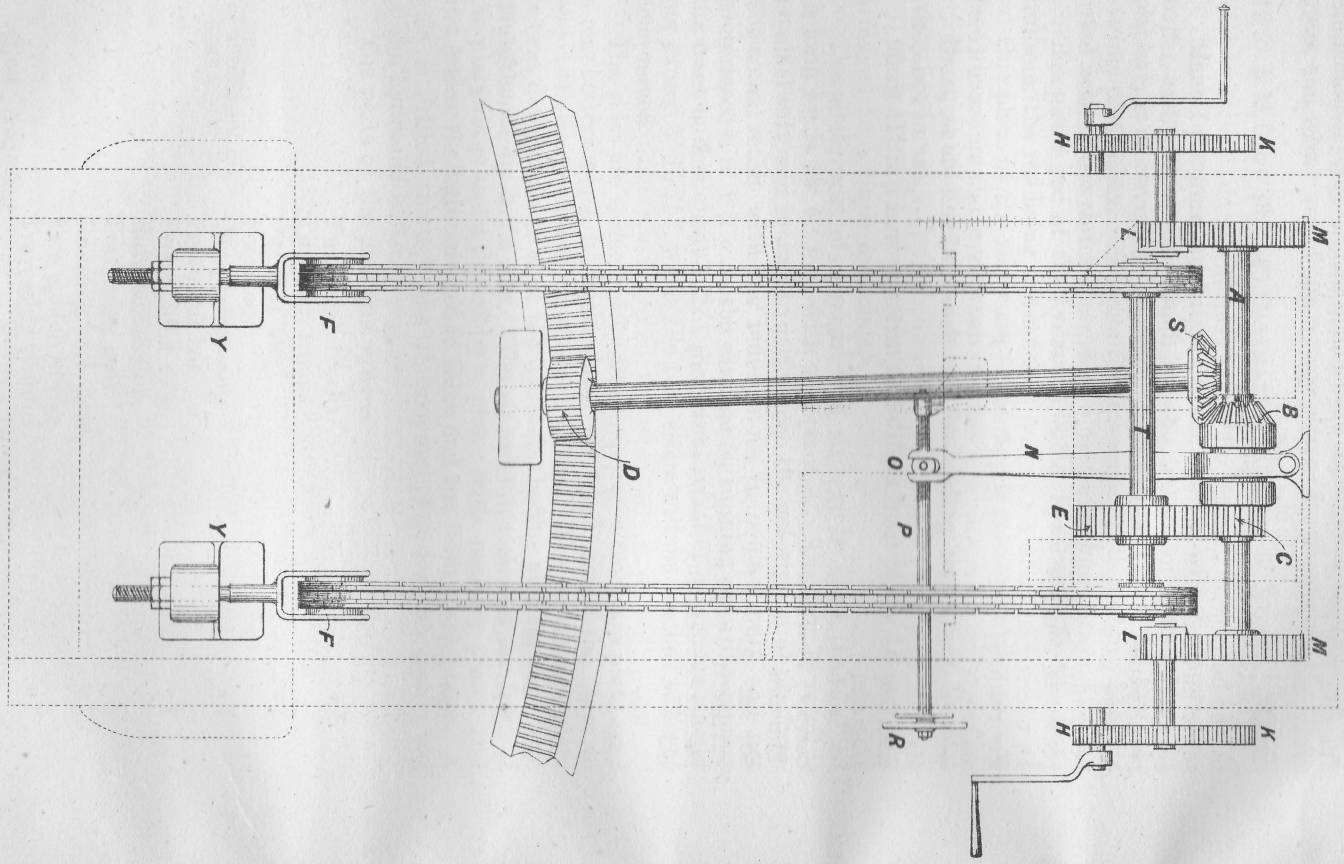
Two brackets of metal for 2nd motion shaft, each with four 1″ bolts.

Two clutch pinions outside brackets of C.I., one right, one left, each with one pair of metal bearings, cast iron cap, two ·875″ bolts and six 1″ bolts.

Two thrust brackets of metal for clutch pinion shaft, each with a steel stud, two ·875″ bolts, and two ·875″tap bolts.

Two clutch pinions inside brackets of C.I. each with one pair metal bearings, C.I. cap, two ·75″ bolts and six 1″ bolts.

# PLATFORM, IRON, WROUGHT, TRAVERSING, CASEMATE, RIFLED M.L. 12·5 INCH 38 TON 6 FT RECOIL MARK I.




12448.

DANCERFIELD, LITH., 22, BEDFORD ST. COVENT GARDEN.

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Cross shaft A for clutch pinions of W.I., 3″ diameter, with two steel studs (ends hardened), coned W.I. collar, three set screws, loose steel collar ·1″ thick, W.I. collar, three set screws, loose steel collar ·2″ thick, W.I. sleeve and two feathers for sleeve.

Two spur wheels M, M, for clutch pinion shaft, 36 teeth, diameter 17·19″, each with two keys.

Two metal guards for spur wheel and pinion, one right and one left, each with metal inscription plate, W.I. guard plate three $\frac{5}{16}$″ bolts, one 1·125″ bolt, two ·625″ bolts, and two ·75″ bolts.

Clutch bevel pinion B, of metal, 14 teeth, 10·03″ diameter.

Clutch spur pinion C, of metal, 12 teeth, 7·64″ diameter.

Friction plates for clutch, 14 of metal, 14 of steel, (12 of each for Mark II platform).

A friction band for clutch of metal.

Bracket of C.I. for clutch lever with eight ·875″ bolts.

Clutch lever N, in two parts, of W.I. with one ·1″ bolt countersunk head, one 1″ bolt joint pin, 1·75″ diameter, and split key.

A friction band in two parts of W.I., with two ·75″ bolts.

A metal nut O, for adjustiug screw of clutch lever, with two metal bearings.

Adjusting screw P for clutch lever of W.I. with collar and taper steel pin, collar and nut.

A metal bracket for right end of adjusting screw, with four countersunk ·75″ bolts.

A metal bracket for left end of adjusting screw, with four ·75″ bolts.

A metal handwheel R, 12″ diameter, for adjusting screw.

A metal disc with spiral groove for pointer.

Indicator pointer of steel.

Indicator bracket of metal with three ·5″ tap bolts.

A bevel wheel S of C.I., 18 teeth, 12·89″ diameter, for traversing shaft.

A rear bracket for traversing shaft of C.I., with two pairs of metal bearings, two C.I. caps, four ·875″ bolts, and six 1″ bolts.

A traversing shaft of W.I., 3·5″ diameter, with two feathers for bevel wheel, collar and keep screw, loose W.I. collar, and two set screws, and two keys.

Traversing pinion D, of metal, 14 teeth, 10·02″ diameter.

A front bracket, for traversing shaft, of metal, with eight 1″ bolts.

A W.I. jointed pointer with two ·625″ bolts.

Two brackets of C.I. for sprocket wheel shaft, one left one right, each with a pair of metal bearings, cast iron cap, two ·875″ bolts and six 1″ bolts.

Sprocket wheel shaft T, of W.I., 3·5″ diameter, with four feathers, two collars, two keep screws for collars, and two keys.

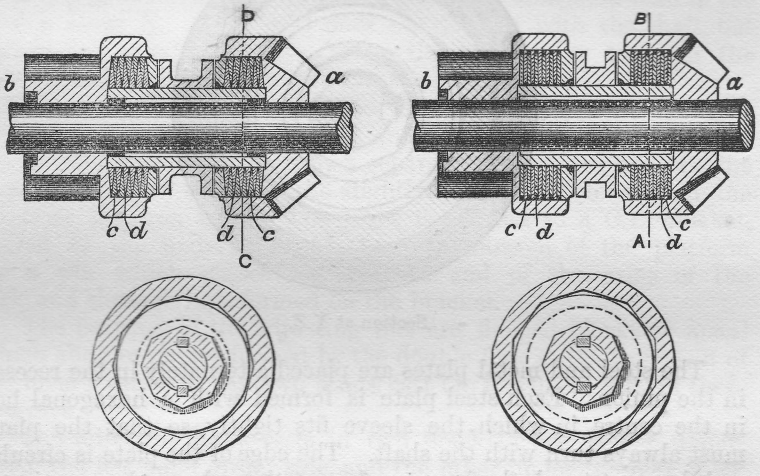
Two sprocket wheels of W.I. for endless chain.

Spur wheel E, of C.I., for sprocket wheel shaft, 30 teeth, 19·1 diameter.
Two forks of W.I. for endless chain, each with two nuts.
Two rollers F, of W.I., bushed with metal, for endless chain.
Axle of W.I. 2·5″ diameter, with split key.
Two brackets of metal, one right and one left for forks, each with metal bush, three copper rings and four india-rubber rings, and eight 1″ bolts.
Two endless chains of W.I. galvanised, each with one screw connecting pin.

A winch handle shaft is placed at the outside of each side of the platform, near the rear. The inner end of the shaft is supported in a bushed bracket bolted to the outside of the side, the outer end is supported in a bearing in the guard, which is bolted, after the remainder of the gear has been put on, to the side, and to the bracket. On each shaft is keyed a pinion H, which gears with a wheel K, secured on a second motion shaft by a key. Each second motion shaft rests in a metal bracket bolted to the under flange of the girder side. To the inside end of each of these shafts is fixed a spur pinion L, which is secured by two feathers and a collar fixed to the end of the shaft by a keep screw. It gears with a spur wheel M, secured near the end of the clutch pinion shaft A, by two keys. At the centre of this shaft is fixed by two feathers an iron sleeve, Figs. 71, 72, the outer surface of which is octagonal in

The clutch. §§ 4026, 4112.

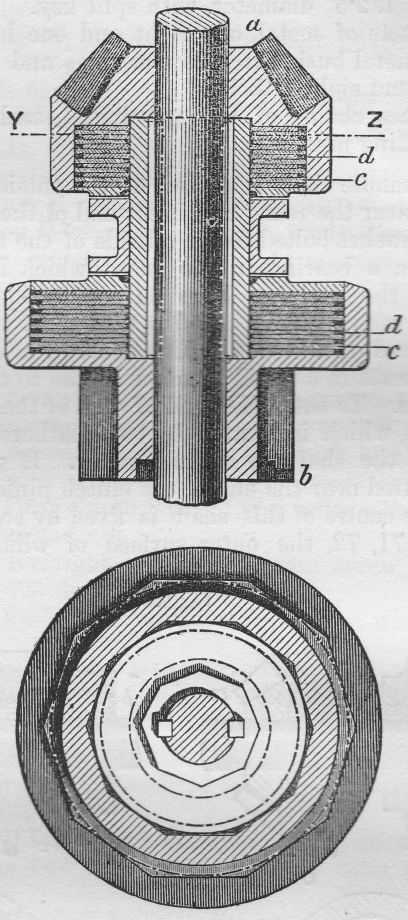
Fig. 71.




form. The clutch pinions, *b*, *c*, work loose on the shaft and against the ends of the sleeve. The spur pinion works against the left end of the sleeve, and is kept in position by a collar and three set screws. The bevel pinion works against the right end of the sleeve and is kept in position by a coned collar and three set screws. Each pinion is formed with a polygonal recess into which the friction plates fit. The plates are made in two sizes; those for the

spur clutch pinion, which works the gear for running back, being larger than those of the bevel clutch pinion working the traversing shafts.

Fig. 72.




Section at Y.Z.

The steel and metal plates are placed alternately in the recesses in the pinion. Each steel plate is formed with a hexagonal hole in the centre, in which the sleeve fits tightly, so that the plates must always turn with the shaft. The edge of the plate is circular, and does not touch the inner surface of the polygonal recess in the pinion, so that the plate and shafts can revolve independently of the pinion.

Each metal plate is formed with a circular hole in the centre, through which the sleeve passes loosely, so that the sleeve and shaft are free to turn independently of the plate. The edge of the plate is formed to fit the polygonal recess in the pinion, so that plate and pinion must always turn together. Thus, each alternate plate must always turn with the shaft or with the pinion; when

the plates are loose the shaft can turn without affecting the pinion, but when the plates are pressed together, and the shaft turned, the friction between the alternate plates will cause the metal plates to turn with the steel ones and thus cause the pinion, which must always turn with the metal plates, to turn with the shaft.

The metal friction band fits on the sleeve between the two pinions, and can slide freely along it but must always turn with the shaft. The outer metal plate of each series is formed with a boss, against which the band works, on the band being forced along the sleeve towards either pinion, the plates in its recess are pressed together and it is caused to revolve with the shaft, when the latter is put in motion.

The shaft rests in four bearings, formed in brackets, one at each end bolted under the girder side, and the other two bolted respectively under a plate and a bar which both connect the rear transom with the rear truck plate.

To each end bracket is fixed a metal thrust bracket formed with a boss, central with the shaft. At the centre of this boss a hole is drilled into which is placed a steel stud with rounded head, a similar stud is inserted in a hole drilled in each end of the shaft. The heads of these studs are hardened and bear against each other, so that when the clutch is put into action the thrust on the shaft is taken on the small surface of the head of the stud.

The iron friction band fits between flanges on the metal band. It is in two parts bolted together round the metal band; on each part a stud is formed, which fits in a slightly elongated hole in the clutch lever N. This band does not revolve with the shaft, but can be moved laterally along it by the lever, so as to press the metal band against one or other of the series of plates.

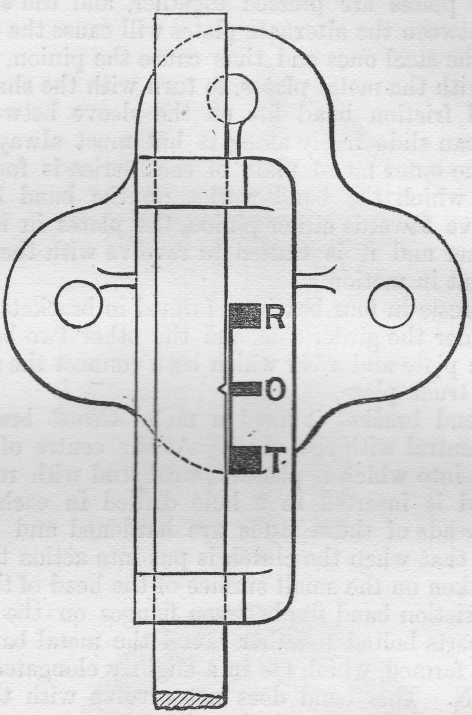
The clutch lever N is formed with a double fork at its front end to carry the adjusting nut O, and with a fork at the rear end, one arm of which is formed by a separate piece bolted on. In the arms of this fork there are the slightly elongated holes to take the studs of the iron band. The lever is pivoted to a C.I. bracket, bolted to the under plate of the rear transom of the platform by a pin which passes through the end of the arms of the fork, and through lugs formed on the bracket.

The bearings of the adjusting nut are flanged blocks of metal which slide in guides formed by the double fork at the front end of the lever; the nut has two studs cast on it which rest in these bearings.

The adjusting screw rests in two brackets, one bolted underneath the left hand girder side, and the other under the rear truck plate. It is secured by a collar with a taper steel pin.

A metal disc and a handwheel R, are secured on the outer end of the adjusting screw. The disc has a spiral groove cut on its inner face, in which works the end of a steel pointer. This pointer slides in a metal bracket, Fig. 73, on the outside of the platform, which has the letters T.O.R. cut on it, showing, in conjunction with a notch on the pointer, the direction it is necessary to turn the handwheel to put the clutch into gear for traversing or for running back. Indicator.

Fig. 73.




For traversing the bevel clutch pinion B gears with the C.I. bevel wheel S, secured to the rear of the traversing shaft by two feathers; a collar is fixed on the end of the shaft by a keep screw. Near the front end of the traversing shaft is fixed, by two keys, the traversing pinion D.

The shaft rests in rear in a bracket formed with a double bearing bolted under the plate connecting the rear transom with the rear truck plate, to which one of the brackets for the clutch shaft is also bolted. In front it rests in a metal bracket bolted under the fourth transom.

For running back the spur clutch pinion C, gears with a spur wheel L, secured by two keys on the sprocket wheel shaft. This shaft rests in bearings formed in brackets, which are bolted to the same bar and supporting plate as the two inside clutch shaft brackets. On each end of the shaft is a sprocket wheel each secured by two feathers, and by a collar with keep screw.

At each side, underneath the front truck plate, is bolted a metal bracket Y, Y, which forms a socket for the shank of the sprocket roller fork. The shank is turned and screwed, but has a square shoulder, which fits in a squared hole at the rear of the bracket. The screwed shank passes through a cylindrical boss formed on the bracket, which is packed with four rings of india-rubber, and three of copper, placed alternately, and is closed by a metal bush. The shank is secured at the front by two nuts. The roller F is metal bushed, and fits on an axle 2·5″ diameter, which rests in the arm of

he fork and is secured by a split key. The endless chains pass over the sprocket wheels and rollers, their ends being united by screwed connecting pins.

For adjusting the forks and tightening the chains, a special spanner is supplied.

Spanner, socket, tightening chains with tommy, and a turn screw connecting chain are used for uniting the chains

Compressor stop and preventor gear.

The compressor stop and preventor gear consists of the following parts :—

Two compressor brackets, one left, bushed, with adjusting nut, one right, bushed with metal; each with four 1″ bolts, two being countersunk.

Adjusting screw of wrought-iron 1·75″ diameter.

Compressor screw of wrought-iron, 2·125″ diameter, with collar and nut.

Nut for compressor screw of metal with three ·625″ screws.

Two compressor plates of W.I., 1″ thick.

Two india-rubber parting pads, ·75″ thick.

Two W.I. pins, 1·75″ diameter, each with split key, for compressor plates.

A W.I. lever for compressor screw, with C.I. counterweight, handle and nut.

Pawl for compressor lever of W.I.

Stud for pawl, with collar and two nuts.

Preventor bar of W.I., 1″ thick.

Front bracket for preventor bar of W.I., with pin 1·75″ diameter, loop head, split pin and two 1″ bolts.

A W.I. tripper.

A W.I. tripper bracket with collar, loop head, split key, and four ·75″ tap bolts.

Buffer spindle of W.I. with nut, loop head, split key, two felt rings, and one parting plate of W.I.

The compressor brackets are bolted over the rear truck plate on the right side; the left hand bracket is bushed with an adjusting nut with screw; the right hand bracket is bushed with a metal bearing for the end of the compressor screw. The two pins are supported in holes in the brackets and are secured each by a split key. The compressor plates and preventor bar are supported between the brackets by the pins, which pass through holes in them. The plates are flat rectangular plates of iron slightly beveled at the front. The india-rubber pads are placed on the pins between the bar and the plates. The preventor bar is supported at the front by a pin which passes through it, and is secured by a split key in a W.I. bracket bolted to the strengthening angle iron of the front truck plate.

The compressor screw passes through a nut bolted to the right girder side and through the metal bush in the right compressor bracket, the end bearing against the right compressor plate. The compressor lever fits on an octagon on the outer end of the screw and is secured by a collar and nut. The lever is fitted with a

counterweight and a handle secured by a nut, which is engaged by a pawl, pivoted on a stud on the girder side. The pawl is formed with a counterweight, which keeps it in position to engage the lever, when depressed.

The compressor stop comes into action when the carriage has recoiled 5′ 2″, by jamming the plates hanging under the carriage and preventing the carriage running up after recoil.

The tripper for the preventor gear, Fig. 51, p. 183, is pivoted on a gudgeon formed on a bracket bolted below the upper flange of the girder on the outside, it engages the compressor lever of the preventor gear on the carriage and puts the gear into action in running up, should the lever not have been raised by hand. A lug is formed on the bracket to act as a stop for the tripper, and to take the spindle of the buffer, which is secured to it by a nut and split pin. The buffer is formed of two pads of felt separated by an iron parting plate.

*Miscellaneous Fittings.*

Miscellaneous fittings.

One pair of winch handle brackets of metal on each side near the rear.

One pair of W.I. brackets for hydraulic jack lever at the centre of the left hand girder side.

Two staples on the left side near the front for strap securing a box tin, grease, half round, 3 lbs., to contain grease for lubricating projectiles.

Four iron loops with nuts, one at front and one at rear on each side.

A steel tipped jointed pointer attached by two ·625″ bolts underneath the rear truck plate on the left side.

A front buffer stop fixed at the front of the platform to prevent injury in running up. It consists of an angle iron secured to the front top plate, a block of wood secured to the angle iron, and six india-rubber rings with wrought iron spindles and split key.

A rear buffer stop is fixed inside each girder side near the rear, to prevent injury on recoil. Each stop consists of a bracket fixed to the platform to which is attached one ring of india-rubber round a spindle secured to the bracket by a split key.

§ 4825. As in the case of lower natures, buffer stops consisting of alternate rings of felt and galvanised iron will be furnished to these platforms after the existing stores of india-rubber rings are exhausted.

A snatch block is fixed on each side of the platform near the front to lead the fall of the loading tackle in the direction required. It is attached by means of a shackle joint with nut and pin to a bracket secured to the outer flange of the girders

A rear step of wood is bolted to the rear transom.

§ 5109. A spring is fitted at the front of the platform to form a rest for the piston rod. It is contained in a metal telescope box, attached to the platform by three $\frac{3}{4}$-inch bolts.

## 12·5″ R.M.L. of 38 tons Casemate Platform, 6′ Recoil. Mark III. Special.

This platform differs from Mark III in having the rear trucks placed 12″ more to the rear in order to lessen the jump. Some minor alterations in the form of the girders and fittings are necessitated by the altered position of the trucks. § 4197.

## 12·5″ R.M.L. of 38 tons Casemate Platform, 7′ Recoil. Marks II and III.

These platforms are generally similar to the 6′ recoil, but are 1′ longer, the length being 16′ 6″. The fittings are modified to suit the increased length. The actual recoil of a carriage on a 7′ recoil platform should not exceed 6′ 8¾″ when the rear stops will be touched but not compressed. The compressor stop should come into action when the carriage has recoiled 6′ 2″. § 4167.

Platforms mounted on turntables as at Gibraltar are fitted with a special rear buffer stop in the centre, with a removeable block at the rear; to allow the muzzle of the gun to pass the work, when moved on the turntable from one port to the other.

## 12·5″ R.M.L. of 38 tons Dwarf Platform "C." Marks II and III.

The frame of this platform is the same as that of the casemate 6′ recoil; it is raised sufficiently high to admit of the gun firing over a 4′ 3″ parapet. § 3098.

The trucks are 24″ in diameter both in front and rear, blocks being inserted between the bottom of each side and the rear truck plate to give the platform the necessary slope.

The gear is similar to that of the casemate platform, but the clutch shaft lies in front of the chain wheel shaft, and is much lower down.

A removeable wood side step is suspended by hooks on each side to staples bolted to the girder sides; an iron step is bolted to the rear transom about halfway between the wood step and the ground.

Snatch blocks for loading tackle are not required on platforms mounted in emplacements having sunken ways for loading stages.

## 12·5″ R.M.L. of 38 tons Dwarf Platform 6′ Recoil, "D" Pivot. Marks II and III.

These platforms are similar in construction, gear and fittings to dwarf "C"; the rear trucks are 18″ diameter, the longitudinal shaft of the traversing gear runs to the rear of the clutch shaft; the traversing pinion is at the rear end of the shaft, and gears with an intermediate pinion, on a shaft below, which also gears with the rack. § 3099.

## 12·5″ R.M.L. of 38 tons, Small Port Platform, 6′ Recoil. Marks II and III.

§§ 4206, 4112

These platforms are generally similar in construction to the ordinary casemate, but are fitted with two hydraulic buffers, the piston rods of which are in compression during recoil.

The term six foot recoil is nominal only, and is used to designate the description of platform. The actual recoil should not exceed 5′ 10¼″, when the rear stops will be touched but not compressed.

The sides are connected by four transoms only, the front truck plate is bent downwards to clear the hydraulic buffers and a semi-circular recess cut on the rear edge, to clear the hydraulic lift on the carriage. A flange of angle iron is riveted round the recess on the under side of the plate. A plate to facilitate the removal of the hydraulic lift is secured to the front transom and extends along the centre of the platform to the fourth transom.

Hydraulic buffer.

The hydraulic buffer is similar in dimensions to that for the ordinary carriage; the cylinder is closed at each end by a W.I. cap. There are four holes in the piston ·65″ diameter. A draw off cock is attached to the outside of each girder side, and is connected with the front of the buffer by a bent copper pipe.

The gear and fittings are similar to those for the casemate platform, except that the positions of the letters on the indicator are reversed. Mark III small port platform takes the same friction disc clutch in the traversing gear as Mark III casemate; Mark II S.P. takes a clutch similar to that for Mark II casemate, but not identical with it.

A rear buffer stop is fixed to the front of the rear transom, it consists of five india-rubber pads, four parting plates, and a block of wood strengthened by an iron band secured to the rear transom by three bolts.

## 12·5″R.M.L. of 38 tons Small Port Platform, 7′ Recoil. Mark I.

§ 4253.

This platform is similar to that for 6′ recoil, but is longer and is not fitted with hydraulic buffers. The actual recoil with the platform when altered and lengthened 3″ by the addition of malleable cast-iron brackets should not exceed 7′ 1¼″, when the rear stops will be touched but not compressed.

Holes are cut for the piston rod of the hydraulic buffers in the front transom, which is strengthened by a plate and packing

§ 4112. pieces.

The friction disc clutch of the traversing gear is identical with that for the Mark III casemate and 6′ recoil S.P. platform.

The rear buffer stop is similar to that on the 6′ recoil platform, but on platforms which have been lengthened, the wood is replaced by an iron block, and two malleable iron blocks are added to prevent injury at extreme recoil.

## CHAPTER VIII.—WROUGHT IRON MEDIUM TRAVERSING PLATFORMS.

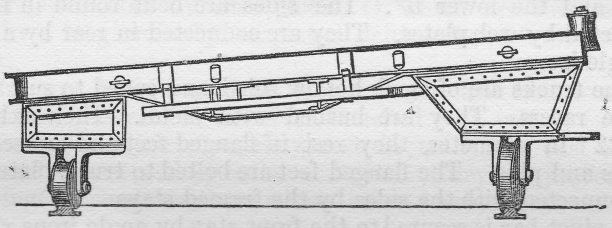
The following table gives the iron platforms which are included under the designation of Medium:—

| No. | Nature. | Weight. | | Tonnage. | Length. | | Slope. | Diameter of Trucks. | | Height of parapet for which intended. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Front. | Rear. | | |
| | | cwts. | qrs. | tons. | ft. | in. | ° | in. | in. | ft. | in. |
| 1 | R.B.L. 7 inch 82 cwt. ... | 50 | 0 | 3·022 | | | 5 | 13 | 18½ | 4 | 3 |
| 2 | R.B.L. 7 inch 82 cwt. ... | | | 3·022 | | | 5 | 13 | 18½ | 3 | 6 |
| 3 | R.B.L. 7 inch 82 cwt. ... | | | | | | 5 | 6·5 | 13 | 2 | 7 |
| 4 | R.B.L. 40-pr. ... ... | 19 | 2 | 1·621 | 8 | 7 | 4 | 8 | 10 | 2 | 3 |
| 5 | R.B.L. 20-pr. ... ... ... | | | | 7 | 2 | 4 | 6·5 | 8 | 2 | 3 |
| 6 | S.B., B.L. 32-pr. ... ... | 13 | 1 | ·706 | 6 | 7 | 10 | 4·875 | 12 | 2 | 3 |
| 7 | R.M.L. 7 inch, 6½ tons ... | 75 | 1 | 4·749 | | | 4 | 13 | 18½ | 6 | 0 |
| 8 | R.M.L. 64-pr. 64 cwt. ... | 69 | 3 | 5·584 | 13 | 0 | 4 | 13 | 18½ | 6 | 0 |
| 9 | R.M.L. 64-pr. 64 cwt. ... | 58 | 0 | 4·077 | 13 | 0 | 4 | 12 | 18 | 5 | 6 |
| 10 | R.M.L. 40-pr. ... ... ... | 24 | 1 | | | | | 10 | 13 | 3 | 6 |

### Platform Medium No. 1, R.B.L. 7″ 82 cwt., 4′ 3″ Parapet, for Carriage No. 1.

Fig. 74.

Scale $\frac{1}{48}$th.



§ 4614.

This platform, Fig. 74, is converted from the naval slide for the R.M.L. 7″ 6½ ton gun p. 385.

The width between the sides is reduced to 2′ 7″ to suit the carriage for the R.B.L. gun; the cross stay and the front and rear rollers and flanges are removed, and wrought-iron trucks with larger flanges substituted for them. The sides are supported over the flanges on wrought iron brackets; the centre bottom plate is removed, tensile stays connected by two cross bars are fitted, one underneath each girder side.

The platform is fitted with platform boards, and the special naval fittings, such as winch gear, pivot flap, pivot plate, and pivot heads are removed. The pivot plate is replaced by a top plate.

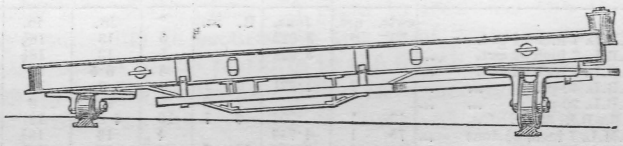
## Platform Medium No. 2, R.M.L. 7″ 82 cwt., 3′ 6″ Parapet, for Carriage No. 1.

§ 4003. This platform Fig. 53, p. 194, is similar to No. 1, but is lower, cast-iron packing pieces being substituted for the wrought-iron brackets on which the girder sides are supported over the front flanges; and the brackets between the rear truck flanges and sides being reduced in height. The trucks are the same.

## Platform Medium No. 3, R.B.L. 7″ 82 cwt., 2′ 7″ Parapet, for Carriage No. 1.

Fig. 75.

Scale $\frac{1}{48}$th.



§ 4614. This platform Fig. 75, is similar to the preceding, but the trucks and truck flanges are smaller, and the sides are supported over the flanges on packing pieces both in front and rear.

## Platform Medium No. 4, R.B.L. 40-pr., for Carriage No. 4.

§ 4235. This platform Fig. 56, p. 197, consists of two sides supported on framed stays and block plates over four steel trucks,

The sides are of girder iron 7″ deep, the upper flange is 4·5″ wide, and the lower 5″. The sides are bent round in front and connected by web plates. They are connected in rear by a transom of angle iron.

The trucks are of steel, hollow soled, and coned to suit the radii of the racers. They are bushed with metal. Their axles are of steel 2″ in diameter, they rest in flanged feet and are secured by collars and pins. The flanged feet are bolted to truck plates, which are connected with the sides by the framed stays.

A pivot bar is secured to the front stay by angle irons riveted to the bar, and to the stay, and is pivoted to an actual pivot in the face of a work by a pivot plug (No. 10).

Fittings. A platform board for use in loading is suspended on each side from staples bolted to the girders.

Stop brackets are bolted on the inside of the sides in rear. Each stop consists of an iron spindle and an india-rubber ring 2″ thick.

## Platform Medium No. 5, R.B.L. 20-pr., for Carriage, No. 5.

§ 4211. A drawing has been sealed to govern manufacture of the above, but no platform of this nature has been made. The design is generally similar to that of No. 4 platform.

## Platform Medium No. 6, S.B., B.L., 32-pr., for Carriage No. 6.

§ 4059. This platform, Fig. 57, page 199, consists of two sides of girder iron connected by a front transom, and by two bottom plates.

The platform is supported on wrought-iron rollers with steel axles, which rest in wrought-iron flanges, bolted beneath the bottom plates.

A bracket for the piston rod of the hydraulic buffer is housed and bolted to the front bottom plate.

A wrought-iron pivot lug is bolted to the front transom, and is secured, when the platform is in position, to the breast of the work by a steel pivot plug with key (No. 11).

The platform is fitted with two front and two rear buffer stops, the front consisting of rectangular india-rubber pads and wooden blocks. The front buffers are fixed to the transom by spindles; the rear buffers are each fixed by a spindle to a stop, hinged on a bracket on the rear bottom plate, and so arranged that it can be folded down to clear the carriage when housed. When in use the rear stops are held in position by small catches fixed to the bottom plate.

A drip pan, No. 12, for the hydraulic buffer, is fixed along the centre of the platform.

## Platform Medium No. 7, R.M.L. 7″ 6½ tons, for Carriage No. 7.

§ 3986. This platform, Fig. 58, page 200, consists of two sides, fish-bellied in form, with the upper flanges of the girders of steel: they are connected by transoms and cross plates. Four malleable cast steel brackets N, N, are bolted beneath the sides at the ends. These brackets are connected by iron plates, O, which are themselves connected by a longitudinal pivot plate P, with holes in it for a C. E. or F. pivot.

Trucks. The platform is supported on four wrought iron hollow soled trucks, front 13″, rear 18·5″ diameter, bouched with metal.

The truck axles are steel, they rest in malleable cast steel flanges Q, and are secured by collar and pins. They are prevented from turning by small feathers which enter feather ways in the flanges.

The flanges fit into recesses in the cross plates and brackets N, each flange being secured by a central bolt, which enters the bracket and is itself secured by a key.

To enable the position of the trucks to be adjusted to suit the different pivots, there is a nib on the upper rim of each flanged foot which can fit into any one of four grooves in the recess in the cross plate.

The position of the truck on the racer will depend on the particular groove, which the nib of the flange is made to enter. The grooves are marked for the pivot to which they correspond.

Running in and out gear. The platform is fitted with running in and out gear, but not with traversing gear.

On a cross shaft between the sides of the platform there is a

spur wheel S, Fig. 58, page 200, which engages the rack under the bottom plate of the carriage. Part of the rim of this wheel forms a drum, round which passes the band of a differential brake, so arranged that during recoil no friction is set up, but the carriage is prevented from running up after recoil. The brake is released when it is required to run the carriage up, by a lever on the left side. To run the carriage back there is a winch handle, W, on each side, which works a train of spur gear acting on the wheel S. A clutch pinion enables the train to be put into or out of gear with the brake wheel as desired.

The following are the parts of the gear:—

A third motion shaft of wrought iron, 3″ diameter, with two metal bearings and two collars and screws.
A spur wheel S, third motion shaft of C.I., 50 teeth, 23·873″ diameter, with two set screws.
A brake band of steel with an adjusting socket.
A lever adjusting brake band of W.I., with two pins each with split key.
A socket adjusting brake band of W.I.
A break shaft of W.I. with washer and screw, one metal bearing and one metal supporting bracket and one metal thrust bracket.
A brake lever of W.I., L., with C.I. counterweight and key.
Bracket C.I. with steel adjusting screw.
A second motion shaft 2·25″ diameter, W.I., with two collars and two metal bearings.
A clutch pinion of metal, 12 teeth, 3·73″ diameter.
A clutch of metal.
A clutch lever of W.I., with W.I. guide bracket, metal bracket and pin with chain.
A second motion wheel T, of M.C.I. 40 teeth, 15·915″, diameter, with key.
A first motion shaft of W.I., 1·75″ diameter, with two collars, two winch handles, and two metal bearings.
A pinion, first motion shaft, of metal, 10 teeth, 3·98″ diameter.

The wheel S, is secured on the third motion shaft by two set screws, the teeth on the wheel engaging the rack uuderneath the carriage. The brake band is passed round a brake drum, formed on the wheel. One end of the band is screwed into the adjusting socket, which is secured to the end of the longer arm of the brake band lever, by a pin secured by a split key. The other end of the band is pinned to the shorter arm of the lever.

The brake shaft passes through the left side of the platform, and rests in the metal bearing, attached to the girder side by two screws, and in the bracket bolted on the pivot plate. The brake band lever is screwed on the shaft by a washer, fixed to the shaft by a screw. The brake lever is keyed on the outer end of the shaft. The counterweight is attached to this handle by a screw. The thrust bracket fits between the drum of the brake wheel, and the shaft ocket of the brake band lever.

The bracket for the adjusting screw is fixed to the outside of the left side of the platform, underneath the end of the handle on the brake shaft. The adjusting screw is screwed throughout its length, it passes through the bracket, and is kept in position by a nut.

The second motion shaft rests in its bearings attached to the sides of the platform, and is secured by its collars, in a similar manner to the third motion shaft. The clutch pinion gears with the wheel S; it rides loosely on the shaft, but is prevented from having any lateral motion by collars on each side fixed to the shaft by screws.

The clutch slides on feathers on the shaft. It has teeth on its inner face, which gear with corresponding teeth on the face of the pinion. The clutch lever consists of a fork connected by a pin to the end of a sliding bar at right angles to it. The ends of the fork fit in a groove round the clutch. The sliding bar is supported at the end nearest the clutch, in a wrought-iron bracket, fixed to the inside of the side of the platform. The other end passes through the side, and has a handle on it, by means of which the clutch can be placed in or out of gear.

A metal bracket fixed to the outside of the side supports the end of the bar. This bracket has arrow heads marked on the edge, which in conjunction with arrow heads on a metal plate, fixed to the bar, show when the clutch is in or out of gear.

When out of gear, it can be secured by a pin attached by a chain to the metal bracket.

The cast-iron wheel T is keyed on the second motion shaft.

The first motion shaft rests in bearings fixed to the platform sides, and is secured by collars on the outside of the sides.

The winch handles fit on the ends of the shaft, which are square, The pinion is keyed on this shaft, and gears with the wheel T.

An indicator plate on each side of the platform, shows the direction the handles should be turned for running back.

During recoil the wheel S is turned by the rack under the carriage; the friction between the rim of the wheel and the brake band tends to move the long arm of the lever towards the wheel and thus slackens the band.

On the carriage commencing to run up after recoil, the friction between drum and band acts in the contrary direction, and tends to move the short arm of the lever nearer the wheel and so to tighten the band, until, if the gear is properly adjusted, all motion of the carriage is prevented. When it is required to allow the carriage to run out, the lever L is raised, which has the effect of turning the brake shaft, moving the long arm of the lever nearer the wheel, and so slackening the band until it is sufficiently loose to allow the wheel to revolve.

Fittings

A loading derrick is fitted to the front of the left girder side It consists of a bent bar of wrought-iron, circular in section, 2·5″ at its lower end, tapering to 2″ at the upper. The lower end pivots in a metal bearing in a C.I. bracket attached by four 1″ bolts to the outside of the left girder side near the front. A projectile cradle is pivoted to the bar at the upper end. The cradle consists

of a curved plate of W.I., formed with a shank which revolves in a metal bearing in the top of the derrick. The cradle is fitted with metal guides for the studs of the projectile, attached by screws.

A wrought-iron bracket for the piston rod of the hydraulic buffer on the carriage is secured to the front of the platform by nine tap bolts.

Two wrought-iron brackets for side arms are bolted on the pivot plate towards the front.

Wrought-iron brackets for buffer stops are fixed to the ends of the sides. India-rubber rings 2″ thick and 3·25″ diameter are fitted on W.I. spindles, 1″ in diameter with flattened heads, secured to the brackets by wrought-iron galvanised keys.

A galvanised iron sponge tank is suspended from staples at the front of the right side.

There are two eyebolts on each side.

A step is suspended from staples on each side.

### Platform, Traversing, Medium, No. 8.

R.M.L. 64-pr., 64 cwt., for carriage No. 8.

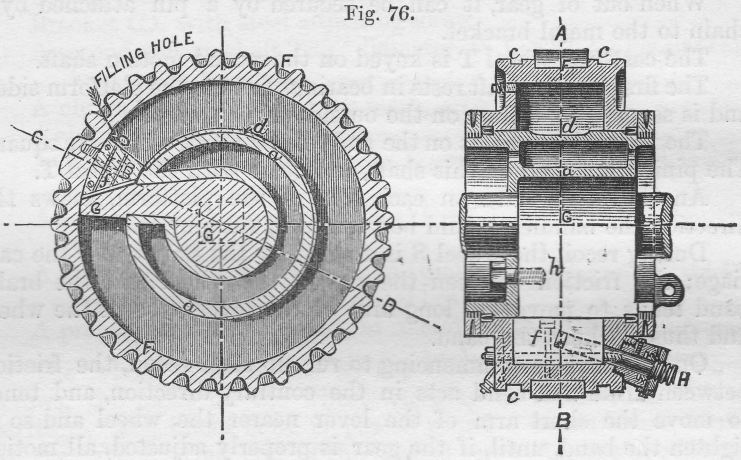
§ 3861. Photo-lithograph, 68.

This platform, Fig. 59 (page 203), is generally similar in construction and fittings to No. 7, but is fitted with a circular buffer to check recoil.

Circular buffer. § 3860.

The circular buffer, Fig. 76, consists of three parts :—

Fig. 76.




A revolving cylinder F. A piston with spindle G.

A regulating valve H.

The piston and spindle G are of W.I., formed in one forging. The ends of the spindle are square and are held in bearings on the inside of the girder sides, so that the spindles cannot turn. On the spindle fits a C.I. boss, *a*, through a slot in which the piston projects. The boss is secured to the piston by the steel tap bolt, *h*, which screws into the piston, and by a steel tap bolt screwed into lugs on the boss on the opposite side.

The cylinder is of metal 22·282″ internal diameter, with a depth of 7″. It has teeth formed on its rim. A valve block is

fixed by tap bolts, and screws in the inside of the cylinder, through which there is an opening, *f*, the amount of which can be regulated by the double screw valve H. The cylinder fits on the boss, and can revolve round it, the teeth on its rim gearing with the rack under the bottom plate of the carriage.

For use, the cylinder is filled with oil, which as the carriage recoils, and the cylinder revolves, is forced by the valve block against the piston. On the boss is a wide shallow groove of varying depth, which forms a passage for part of the fluid past the valve block during recoil.

The joint between the cylinders and boss on each side is made by a U leather ring, kept in position by a metal gland ring screwed on the end of the boss.

The valve consists of a metal spindle, screwed at one end with a left-handed thread, and having a metal disc attached to this end by a screw; the spindle screws into a short outer screw, having a right-handed thread on its exterior surface, which works in a nut screwed to the outside of the cylinder. The valve spindle passes through the nut and cylinder into the channel in the valve block. It is prevented from turning by a steel screw which is fixed to the nut, the point of which enters a groove in the valve spindle. This screws also limits the travel of the valve.

The outer screw has a milled edge at the end to facilitate its being turned; a scale is graduated on its outer face, by which, in conjunction with an index on a steel clip plate, the valve can be adjusted as required. When set the valve is clamped by a nut acting on the clip plate, which is on the upper side of the fixed metal nut, and which is made to grip the milled edge of the outer screw.

There is a filling hole at one side of the cylinder and an emptying hole at the other, each closed by a screw plug attached by a chain.

The weight of the buffer is 9 cwts. 3 qrs. 9 lbs., and the working contents 5 gallons.

Part of the rim of the cylinder at each side of the teeth is turned to form a drum, round which pass the bands of a differential brake, arranged similarly to that for platform No. 7.

The gear for running in and out is also similar to that on platform No. 7, the buffer itself answering to the third motion wheel.

The second motion shaft is fitted with a pawl wheel, 12 teeth, 5·25″ diameter, with which a pawl with counterweight attached to the inside of the right girder side engages. The shaft is thus prevented from turning in the direction for running out, should the clutch have been left in gear.

The following special implements are required with the buffer:— § 4983.

*Spanner No.* 1.

Box, piston and valve block.

*Spanner No.* 2.

Locking valve.

*Wrench No.* 1.

Gland rings.

*Wrench, No 2..*

And screw driver, securing valve and valveblocks with tommy.

*Ring.*

Metal guide, leather packing.

The spanner No. 1 of wrought-iron, 14·25″ long, with a 1·25″ stem. Each end is formed into a box spanner, the larger for the 1·25″ tap bolt H, which secures the piston in the boss; the smaller end is for the ·75″ tap bolt which secures the valve block. Two holes are drilled near the smaller end to take the point of the wrench, No. 2, which is used as a tommy. Weight 7lb. 10oz.

Spanner No. 2 is a small single ended spanner of steel, 4″ long. It is used for tightening the clip which locks the valve. Weight, 1½ozs.

Wrench No. 1 is of flat steel 2′ 5·5″ long, 1·5″ wide and ·375″ thick. It is used to tighten or remove the gland rings. One end is curved and has a steel stud which fits into holes in the ring. Weight 5 lb. 5 oz.

Wrench No. 2 is of steel 15·5″ long. One end is shaped to fit partially round the valve nut and has a stud, which enters holes in it. The point at this end is formed as a screw driver for the inside screw securing the valve block.

The other end is formed so that it can be used as a tommy for the No. 1 spanner. A 12″ steel tommy is supplied with the wrench to turn it when used as a screw driver. Weight 1 lb. 15 ozs.

The ring is of metal 14·25″ in diameter, 1·75″ wide, and 1·75″ thick. It is intended to be placed over the threads on the boss of the buffer, while the U leather rings are being placed in position to save the latter from injury. Weight 4 lb.

### Platform, Traversing, Medium, No. 9.

R.M.L. 64-pr. 64 cwt., 5′ 6″ parapet, for carriage No. 9.

§ 3834. The platform Fig. 60 (page 204), is generally similar in construction and fittings to No. 8, but is fitted with an ordinary hydraulic buffer in compression. The diameter of the holes in the piston is ·8″, and the working contents 5 gallons.

### Platform, Traversing, Medium, No. 10.

R.M.L. 40-pr. for Carriage No. 14.

A drawing has been sealed to govern manufacture, but no platform of this nature has yet been constructed. The design is generally similar to that of the dwarf platform for the 7″ R.M.L., but is intended for a 3′ 6″ parapet. The recoil is checked by a hydraulic buffer in compression.

# CHAPTER IX.—MONCRIEFF MOUNTINGS.

The following table gives the Moncrieff mountings for garrison service.

Table.

| Nature. | Mark. | Weight.* Part. | tons. | cwts. | qrs. | Tonnage. Tons. | Height of Axis of Trunnions. Firing position. ft. | in. | Loading position. ft. | in. |
|---|---|---|---|---|---|---|---|---|---|---|
| 7″ R.M.L. of 7 tons. | I. | Carriage | 1 | 15 | 0 | — | †11 | 0 | 7 | 1 |
| | | Elevator | 14 | 17 | 0 | — | | | | |
| | | Platform | 5 | 13 | 0 | — | | | | |
| ,, ,, | II. | Elevator | 14 | 9 | 2 | 14·48 | ‡12 | 3½ | 5 | 8 |
| | | Platform | 8 | 8 | 2 | 7·93 | | | | |
| 7″ R.B.L. of 82 cwt. | II. | Elevator | 8 | 19 | 2 | — | 10 | 5¾ | 5 | 1½ |
| | | Platform | 4 | 3 | 1 | — | | | | |
| 64-pr. R.M.L. of 58 cwt... .. | II. | Elevator | 7 | 14 | 2 | 5·028 | 10 | 5 | 4 | 9½ |
| | | Platform | 3 | 14 | 2 | 4·924 | | | | |
| 9″ R.M.L. of 12 tons. | II. | Elevator | 26 | 13 | 0 | 7·00 | 14 | 0 | 6 | 11½ |
| | | Platform | 13 | 12 | 2 | 19·256 | | | | |

* With gear. † To fire over a parapet 9½′ or 10′ high.
‡ To fire over a parapet 11′ high.

There are two descriptions of the above mountings in the service, designated respectively Mark I and Mark II.

In the Mark I mounting the gun with its carriage are placed in a structure termed "an elevator," which rolls upon a traversing platform and which is so formed as to bring the gun into the required position either for loading or running up.

At the opposite end of the elevator to that in which the gun is carried, there is a counterweight, which is raised by the force of recoil, as the gun rolls back to the loading position. On releasing a brake, which retains the elevator in the loading position after recoil, the weight of the counterweight causes the elevator to roll forward and raise the gun into the firing position.

In Mark II mounting the elevator itself forms the carriage for the gun, but in principle the mounting is similar to Mark I.

## 7″ R.M.L. OF 7 TONS CARRIAGE. MARK I.

### THE CARRIAGE PROPER.

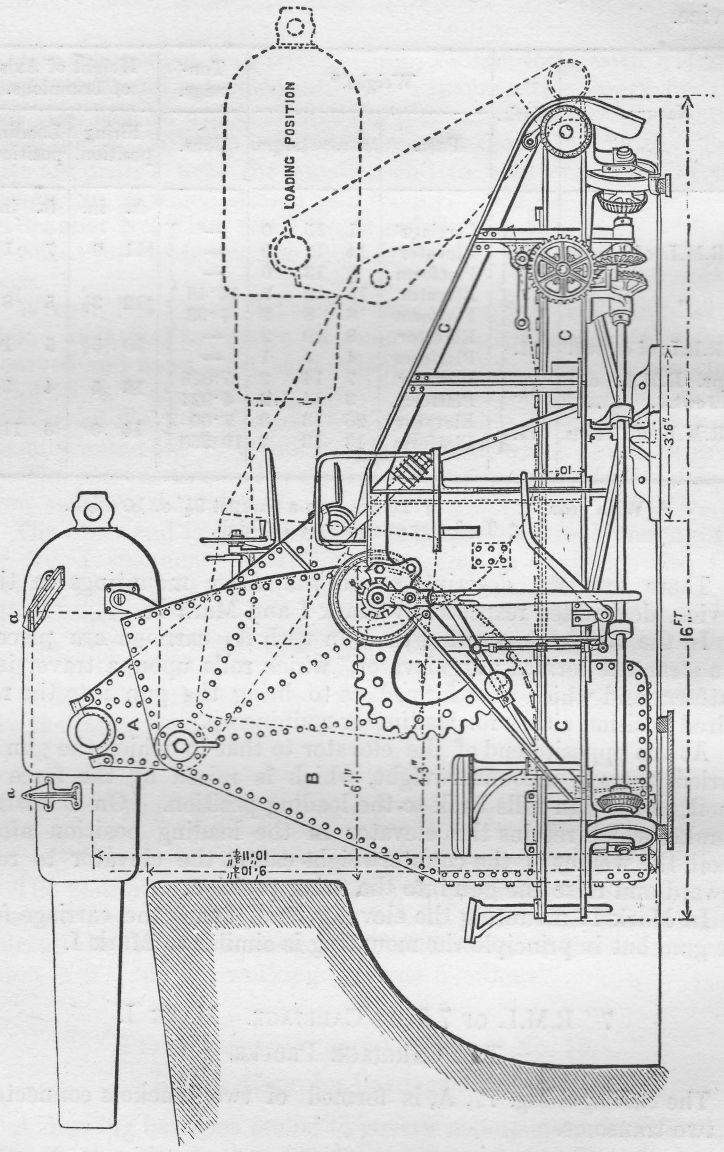
7″ R.M.L. of 7 tons carriage. Mark I. (See R.C.D. photo-lithographs, 60A and 60D.) The carriage proper. L. of C., § 2667.

The carriage, Fig. 77, A, is formed of two brackets connected by two transoms.

The brackets are nearly triangular in shape, and are each composed of a wrought-iron frame $3\frac{1}{2}''$ wide, with a $\frac{1}{2}''$ plate riveted on either side. In the upper part is the trunnion hole, fitted with a metal bearing plate and a capsquare secured by clips with screws

and bolts; in the lower part to the front is a metal-bouched hole to receive the shaft which connects the carriage to the elevator, while in the rear a wrought-iron axle is secured. The latter passes

Fig. 77.




from one bracket to the other, and has near its extremity outside each bracket a wrought-iron truck with securing collar. The axle has a piece of angle iron, bolted along its upper surface, and

another piece along its under side; it is secured to each bracket by two knees and a stay.

The transoms are of plate connected by means of angle iron to the brackets; the front is placed vertically, the rear horizontally.

The second or rear transom supports the elevating arrangement, which consists of the following parts, namely:—

One shaft.
The pinions.
Two elevating arcs.
Two clips.
Two nuts.
One worm wheel, comprising two friction cones and one metal band with teeth.
One worm shaft with two hand wheels and a locking handle.

The elevating arcs are pivoted to the gun in the usual manner, and the right-hand arc is graduated with degrees, a pointer being fixed upon the bracket by which to set it.

The elevating shafts rests in metal bearings in the brackets and in a third bearing bolted to the transom. The pinions upon this shaft gear in the elevating arcs, the latter being kept in position by the clips. On the right of the shaft is the worm wheel, which is worked by the worm shaft, the latter being supported in metal bearings, one on the front transom and two on the rear transom.

To allow of some slip (about 2°) of the arcs on firing, the worm wheel is made composite, in a similar manner to that in Mark II, to be hereafter described. A locking handle is placed upon the rear of the worm shaft; turning it presses a nut against a collar on the shaft and prevents the latter moving, and consequently the worm wheel, on firing.

A laying stage is attached to the rear transom, and a step to mount to it to the rear of each bracket.

## The Elevator.

The elevator, B consists of two sides connected at the lower part by wrought-iron boxes, which contain the counterweight, and at the upper part by a transom. The elevator.

The sides are formed in the same manner as the brackets of the carriage: their rear edges or surfaces are curved, and have teeth formed on them to guide the elevator in its rolling upon the platform and to prevent slip. The counterweight boxes (three two side and one centre) are bolted between the sides in such a manner that when the gun is raised to the firing position they lie between the sides of the platform. These boxes are packed with pieces of cast iron and wood. In the upper part of the elevator are metal-bouched holes to receive the main shaft, which connects the carriage to it. Upon the extremities of the shaft outside each bracket is a loop washer secured by a screw.

A cycloidal rack is bolted to each side of the elevator for

pinions on the platform to gear into, by which the elevator can be moved to any position by hand.

A shot guide is bolted upon the lid of the centre counterweight box to facilitate loading.

## The Platform.

The platform. The frame of the platform C, consists of two sides connected by four transoms, a cross stay and a pivot stay, and fitted with flat-soled trucks in flanged feet. Fixed upon the sides of the frame are guides for the trucks of the carriage to run on, and also walls to support break gear, &c.

The sides are of girder iron, and are straight throughout their length; they are 16′ long, and placed so as to be 5½′ from outside to outside.

The second and third transoms are of plate riveted to angle iron; the front and rear are of plate only, the latter placed horizontally; all four transoms are bolted between the sides, the first and second being strengthened by long knees.

The cross stay is of girder iron, and is bolted beneath the sides 9½′ from the front.

The pivot stay is a diagonal stay of plate iron; its centre, in which is a hole for a pivot, is bolted under the centre of the cross stay, and its arms under the sides.

The flanged feet are bolted beneath the sides, those in front projecting outwards; two have metal bearings for the axles of the trucks. The latter are of wrought-iron, 16″ in diameter, and their axles are of steel.

The guides are of angle iron, and stand one along each side, supported by stays of tee iron.

The walls are of plate, each in the form of a box open at the top and the bottom, extending from the top of the highest part of the guide to the lower edge of the side. They are riveted to four of the stays of the side, and are supported also by a piece of tee iron fixed across and under the platform.

A guide rack to guide the elevator in its motion is fixed along the upper surface of each side; it has teeth in it corresponding to those in the elevator, and a stop at each end.

Brake. Brake gear, for the purpose of holding the elevator down after recoil and controlling its rise, is fitted on each side of the platform. It consists, on each side, of a shaft supported in metal bearings on the upper part of the wall; on the inner end of the shaft there is a pinion gearing in the cycloidal rack of the elevator, on the centre a brake drum, towards the outer end a ratchet wheel, and on the outer extremity a socket to receive an iron-pointed lever. The brake drum with the gear connected with it is similar to that of Mark II carriage, page 265, except that the ratchet wheel is of wrought-iron, and that the brake band is of steel lined with wood.

These drums are marked R and L and are not interchangeable from one side of the platform to the other.

A sliding locking plate is bolted on the front of each wall to secure the gun when left standing in the loading position; to use the bolt its retaining screw is withdrawn, and it is allowed to drop on the short arm of the bent lever, in which position it is secured by its screw; it acts by preventing the arm rising and the friction band being thereby loosened.

Loading stage.

A loading stage on two supporting bars is fitted across the breast of the platform, and two others, one on each side, near it, for the numbers loading the gun; the latter stages are pivoted each on a single supporting bar, so that they can swing clear of the elevator as the gun rises to the firing position.

Two other stages, with guard irons and ladders to ascend by, are fitted one on each wall of the platform.

A preventor hook with india-rubber washers, separated by plates, is supported in a cast-iron socket bolted to the top of the rear of each wall. The hooks catch the points of the axletree arms of the carriage and arrest the latter when run up.

A bollard is fitted on each side of the platform in rear, to take, on emergency, a preventor rope led from the loop washer on the main shaft of the elevator. On the inner side of the bollard there is a ratchet wheel, in which a pawl pivoted on the guide drops, so that the bollard can only turn in one direction.

Pointer.

A pointer, consisting of a small plate of steel which fits over the racer is attached by an arm to the flange of the left rear truck, so that in firing at any fixed object the correct line of fire can be adhered to by marking the racer.

The platform is fitted with traversing gear, as follows:—

Traversing gear.

A long and a short shaft are held in cast-iron brackets under the left of the platform; they lie in prolongation of each other, and at an angle to the side. On the front extremity of the long shaft there is a bevel pinion (14 teeth) gearing into a bevel wheel (18 teeth) on the spindle of the front truck; on the rear extremity of the short shaft there is a similar pinion gearing into a bevel wheel (26 teeth) on the rear truck; upon the other extremities of these shafts there are mitre wheels (30 teeth) facing each other. Gearing into these latter is a mitre pinion (15 teeth) on a short vertical shaft placed between them. Upon the upper extremity of this vertical shaft there is a second mitre pinion (15 teeth), which is driven by another pinion on a cross shaft. The latter passes through the sides of the platform, and has upon each extremity a spur wheel, which is driven by a pinion and winch handle. The spur wheels and pinions are covered by guards, and also the pinion gearing into the front truck wheel.

Painting.

The interior of the counterweight boxes and of the brake drums receive two coats of red lead; with the exception of these parts and of bearing surfaces, &c., which are not painted, the carriage, elevator, and platform receive two coats of Pulford's black.

## 7″ R.M.L. of 7 Tons Carriage. Mark II.

### The Elevator.

7″ R.M.L. of 7 tons carriage. Mark II. (See R.C.D. photo-lithographs, 60F and 60G.) Plate XLV. L. of C., § 2914. The elevator.

In this pattern the elevator is constructed of two double-plate sides (as in Mark I), the frames of which, of cast iron, are $2\frac{1}{2}$″ wide, and the plates $\frac{3}{8}$″ thick. These are connected at the lower part by the counterweight, which is secured between them by bolts, and consists of solid blocks of cast-iron. In the upper part of the sides trunnion holes are formed and fitted with movable metal cylindrical bearings and with capsquares which slide into position and are secured by screws. An eyebolt to take a preventor rope on emergency is screwed into each trunnion of the gun, and as there is no transom between the sides of the elevator, the gun itself is made to serve as one by placing a large washer on the trunnion which is secured by the eyebolt.

There are no cycloidal racks for pinions on the elevator, but instead there are what are termed "retaining racks" on the platform, to which the elevator is attached by connecting bars. One end of each of the latter is metal-bouched, and both pivot on a spindle passing through part of the counterweight and the sides of the elevator.

To carry the breech of the gun and also give the required elevation in laying, a long elevating bar, A, Fig. 1, Plate XLVI, is attached to a metal patch under the breech by a bolt, which also supports a laying stage; the lower extremity of this bar is pivoted between two radius bars B, B, one end of each of which is bent outwards and attached to a spindle in the side of the elevator, while their other extremities hold a metal roller between them. This roller runs in an elevating guide on the platform, to which the required degree of elevation is given and communicated by the elevating bar to the gun. On recoil the roller of the radius bars travels to the rear along its guide, while the elevating bar changes from a vertical to nearly a horizontal position.

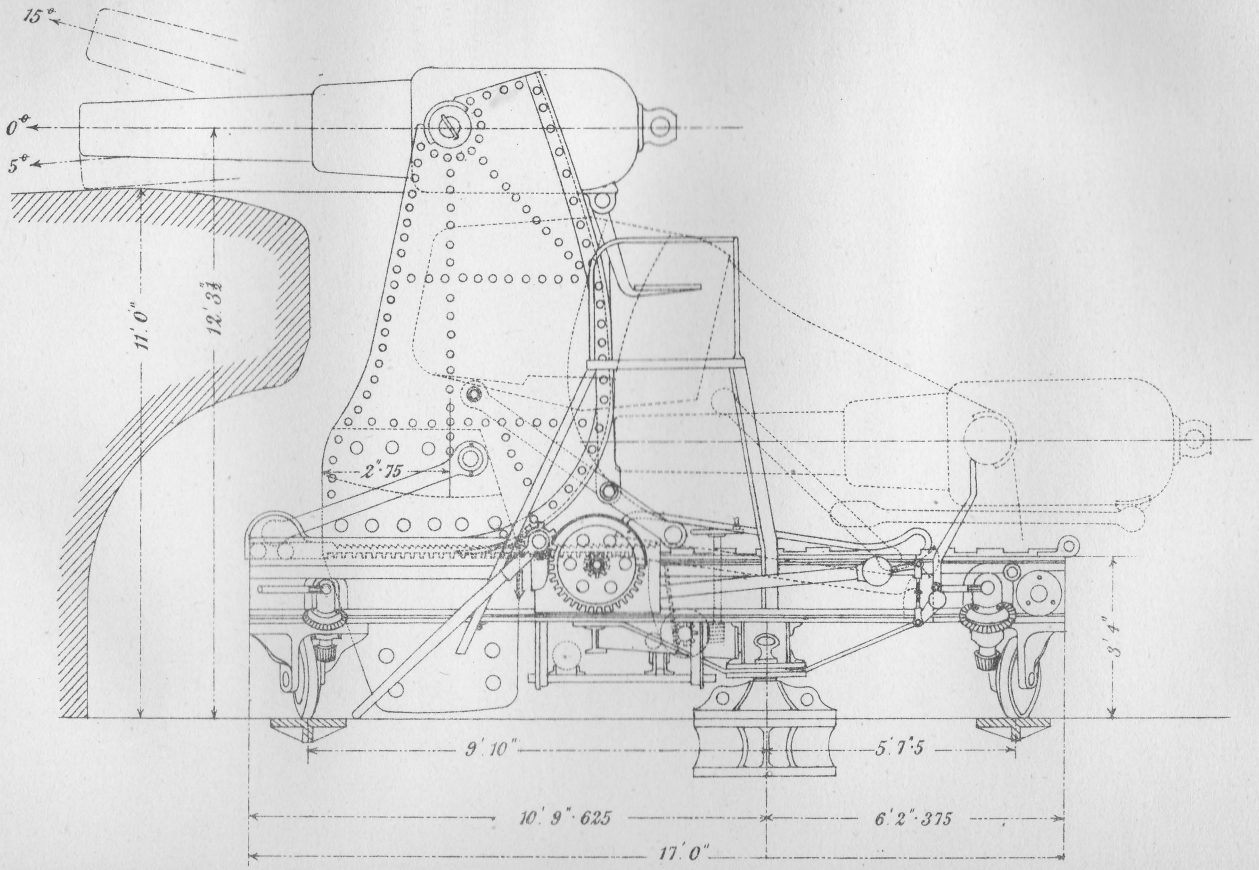
### The Platform.

The platform.

The sides of the platform are 17′ long and placed 4′ $9\frac{1}{4}$″ apart, from outside to outside; they are built up of two bars of channel iron, 1′ 2″ in depth, along which, above and below, 1″ plate iron is riveted.

Three transoms connect the sides; each is formed of plate riveted between frames of angle iron; in the front and rear transoms the frames extend all round the plate, but in the centre transom only along the sides and lower edge. The latter transom extends a little below the lower surface of the sides and not so far as the upper surface. In addition to the transoms connecting the sides there is underneath them a trough-shaped cross stay, through the bottom of which the pivot bolt passes, 10′ $9\frac{5}{8}$″ from the front; this stay is strengthened by a band of plate iron passed under each end and bolted under the sides.

# CARRIAGE, IRON, WROUGHT GARRISON, RIFLED. M. L. MONCRIEFF, WITH PLATFORM, 7 INCH 7 TONS, MARK II.




To face page 264.

DANGERFIELD, LITH. 22 BEDFORD ST. COVENT GARDEN.

The flanged feet for the trucks are bolted immediately beneath the sides, and the trucks are flat soled, of cast iron (21″ in diameter).

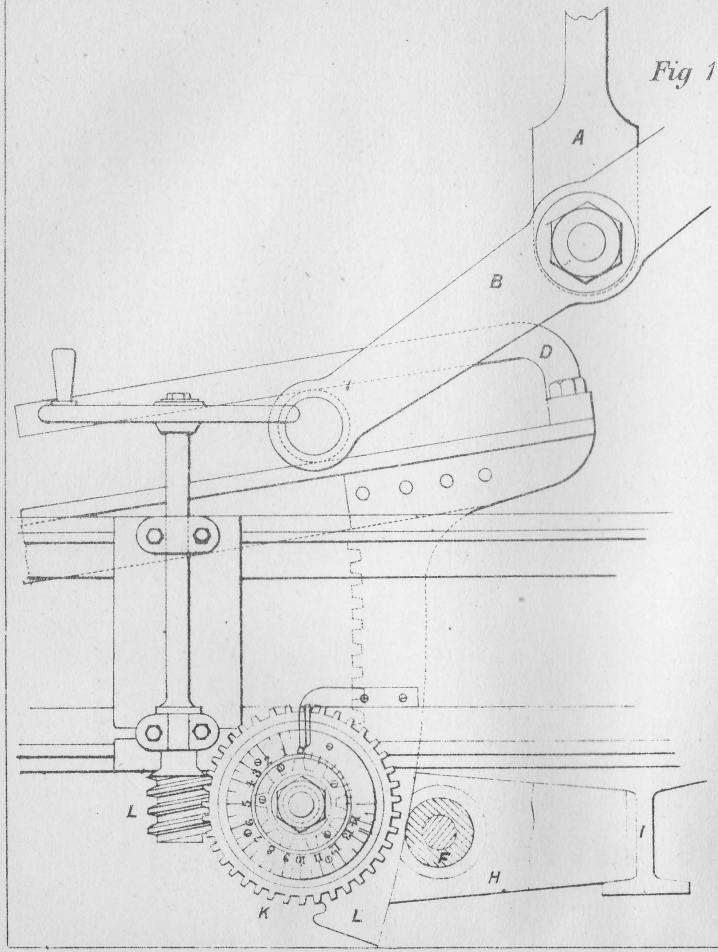
A rack for the elevator to roll along is fitted on each side, and as already mentioned, a sliding retaining rack to which the elevator is attached and by means of which its motion in rising is controlled. The rack moves upon the top surface of the side to the front, being retained on it by a wrought-iron plate fitted to the outside of the side and by a clip bolted to the latter; it is made, as it were, double, its upper surface with teeth to receive a pawl by which it and consequently the elevator can be held when left in the loading position, and its under surface with teeth for a pinion to gear into, by which it can be moved and consequently the elevator. Retaining rack.

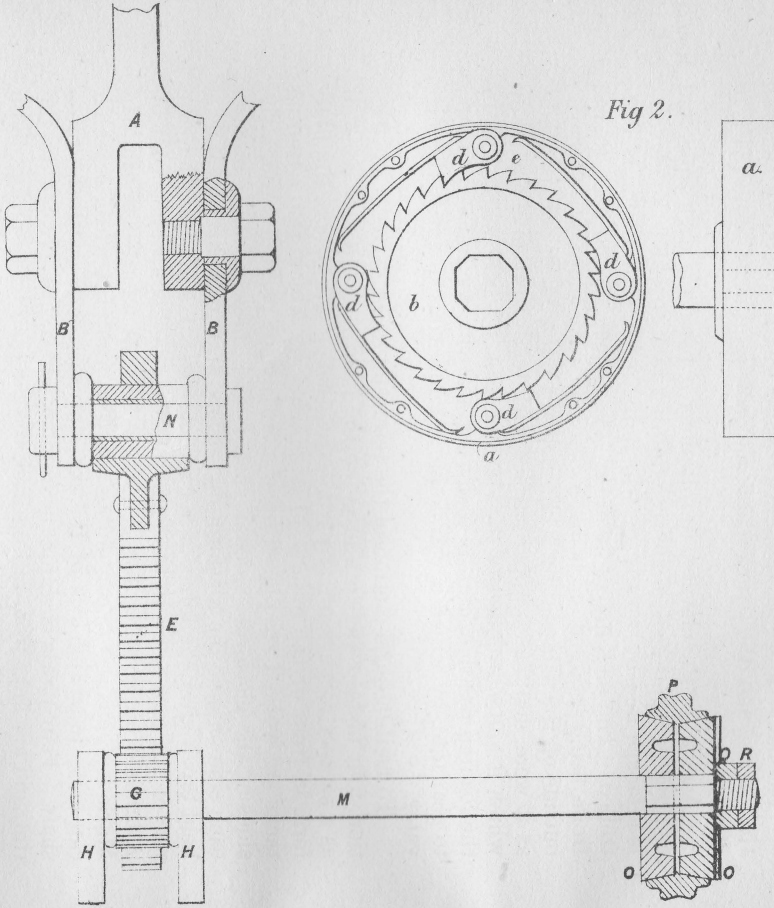
To facilitate the motion of the retaining racks by reducing friction, four metal rollers are fitted on the front of each rack as well as a scraper to push off any sand, &c., that might fall on the platform in front of the rollers. The pinions by which the retaining racks are worked are placed upon a cross shaft passing through the sides of the platform which is fitted with brake drums, one on each side outside the platform, by means of which the elevator is held down after the force of recoil has ceased, and by which the rise of the gun again to the firing position is kept under control. A brake drum consists, Fig. 2, Plate XLVI, of a cast-iron rim (in Mark I of metal)* *a*, containing a cast-iron ratchet wheel *b*, which can move independently of the rim, but must move with the cross shaft. Four pawls *d*, *d*, for the ratchet wheel are pivoted to the rim, and are kept from falling back too far each by a spring. The ratchet wheel with its pawls are enclosed between two wrought-iron plates *e*, *e*, let into and bolted one on each side of the rim.

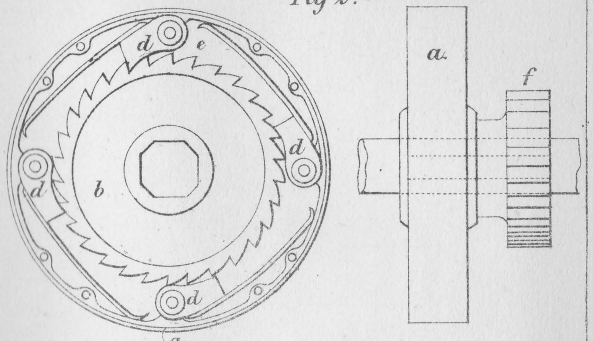
Round the brake drum passes a friction band of iron, one end of which is fixed to the side of the platform and the other to a bent lever. The latter is pivoted to the platform near its bent end, while the other arm, which lies along the platform towards the rear, is weighted with a cast-iron sliding weight secured by a screw. The weight is so adjusted as to tighten the friction band sufficiently to hold the brake drum, so that the pawls of the latter may prevent the ratchet wheel turning back and the elevator rising as soon as the force of recoil has ceased. When the weighted arm of the lever is raised, and the friction band thus loosened, the whole of the brake drum is allowed to revolve and therefore the elevator to rise. In order that the brakes on each side of the platform may be worked simultaneously a cross shaft is fitted through the sides of the platform to the rear, to each end of which a bent lever is attached. The counterlever of the latter is connected by a small shaft, which has an adjusting screw on each end, with the weighted lever of the friction band. Pulling the end of the bent lever to the rear raises the weighted lever and loosens the band, and not only on the side of the bent lever used, but also, by means Brake.

* Since April, 1886, these drums have been made of M.C.I.

# ELEVATING AND BRAKE GEAR FOR MONCRIEFF CARRIAGE MARK II, FOR 7" M.L.R. 7 TON GUN.




To face page 265.

12448.

DANGERFIELD. LITH 22. BEDFORD ST COVENT GARDEN.

of the cross shaft, on the other side also, if the adjusting screws are properly set.

A spur wheel is fitted on the brake shaft outside each brake drum, a pinion to the front gearing into it, on the spindle of which is a movable socket with pawl for the purpose of moving the elevator by hand into any required position; the pinion is fitted with a handle so that previous to running up or firing it may be pushed out of gear. The pawl is double, so that it will act either way; when it is in gear with the ratchet wheel and the socket is worked by an iron-pointed lever, the shaft is turned and its pinions move the elevator.

The brake drums and the pinions are covered by guards.

The elevating guide D, Fig. 1, Plate XLVI, to receive the roller N of the radius bars, lies along the centre of the platform to the rear, being pivoted on a support which rests upon a piece of tee iron fitted across the platform.

Elevating gear.

To give the elevation required in laying the gun, an elevating arc E is attached beneath the front of the guide, and passes down between a friction roller F and pinion G, by the latter of which it is worked. These are supported between two plates H fitted beneath the platform from the front of the cross stay to a piece of girder iron I riveted under the centre transom. The pinion is upon the inner end of a short shaft M, the other end of which passes through the right side of the platform, and has upon it a worm wheel K, which is worked by a worm shaft L fixed vertically on the side, and turned by a hand wheel. The worm wheel, in order to allow of some slip of the elevating arc on firing, and so reduce the shock on the parts, is made composite (as in Mark I); it consists of two frustra O, O, Fig. 1, of a cone, placed top to top (not touching), and turning with the shaft M; over these the worm wheel proper is placed in the form of a band P. By this arrangement, when the frustra are pressed towards each other the band is tightened upon them, and *vice versâ*. The tighter the band is made the less will be its slip, and consequently that of the elevating arc. The frustra are pressed together, as desired, by means of a nut Q, outside of which there is a locking nut R. A graduated dial plate is attached to the cone of the worm wheel, and a pointer to the side, the latter should point to zero on the former when the gun is laid P.B.

Loading stage.

A loading stage is formed between the sides at the centre by boards supported on angle-iron frames. The projectile is hoisted to the muzzle by means of a chain over a block attached to the counterweight, which is led by a leading block on the side of the elevator and another on the stage to the outside of the platform. Two wooden trays are fitted, one on either side of the platform, inside, to receive the side arms.

A stage with ladder is fixed on the left side of the platform, which is fitted with bollards similar to those in Mark I, and also with loops for the standing blocks of tackles when necessary for hauling down.

Traversing gear.

Traversing gear is fitted to the platform, to the left front, and

to the left rear trucks, independent of each other. It consists for each truck of a bevel wheel on the truck worked by a bevel pinion on a very short shaft, which is held in a bracket bolted on the outside of the side. The shaft has a bevel wheel on its upper extremity, into which a pinion moved by a winch handle gears.

A pointer is attached to the left rear foot.

### 7″ R.B.L. of 82 cwt. Carriage. Mark II.

7″ R.B.L. carriage. Mark II.

This carriage is of similar construction to that for the 7″ R.M.L. gun of 7 tons, but the sides of the platform are of girder iron 10″ deep, 5½″ wide in the flange, and 15′ 3″ long; they are placed 2′ 9¼″ apart. There is but one brake drum, upon the left of the platform; the elevator is moved by iron-pointed levers working in capstan heads, one upon each end of the brake shaft; the trucks of the platform are 1′ 8″ in diameter.

### 64-pr. R.M.L. of 58 cwt. Carriage. Mark II.

64-pr. R.M.L. carriage. Mark II. R.C.D. photo-lithographs, 60ɪ, 60ᴋ, 40ʟ.

The 64-pr. carriage is the same as the preceding in its construction; the sides of the platform are the same in length and scantling as the preceding, but placed 2′ 2¼″ apart. This platform has but three trucks, one 2′ 0″ in diameter in rear, and two 1′ 6″ in diameter in front; it is not fitted with traversing gear, but is traversed by iron-pointed levers which enter holes in the rim of the trucks.

The gun when mounted will fire over a parapet 9′ 4″ high.

### 9″ R.M L. of 12 Tons Carriage. Mark II.

9″ R.M.L. carriage. Mark II. L. of C., § 3115.

This carriage is constructed in a similar manner to the Mark II for the 7″ R.M.L. of 7 tons, but the sides of the platform are of girder iron 19′ 9″ long by 12″ deep, and 6¾″ wide in the flange; each side is strengthened by ¾″ plate riveted along the under flange of the girder, and by 1½″ plate along the web; the transoms and cross-stay for the pivot bolt are also of girder iron. The platform is supported upon six trucks, each 2½′ in diameter, the centre being to the front of the pivot and set to the same radius as the rear trucks are to the rear of it. Traversing gear is applied to the left front and left rear trucks, as in the 7″ platform, but in that of the rear truck a clutch is added to the spur wheel on the same axle as the pinion, which gears into the truck wheel, so that it may be thrown out of gear when the gun is in the firing position and being traversed by the front truck only.

In the gear for moving the elevator by hand the spur wheel is movable round the brake shaft, having within it two pawls with springs, which act in a ratchet wheel fixed on the shaft; in recoil the pawls do not act, but supposing the elevator not to have re-

coiled sufficiently, on turning the spur wheel by its driving pinion and lever, the pawls will act in the ratchet wheel and the elevator be brought down. Also, in case of the elevator not rising sufficiently, in order to push it up, as the pawls of the spur wheel would not then act, there is a loose key with handle by which the spur wheel can be keyed to the ratchet; care must be taken before running up or firing that this key is withdrawn.

For raising the projectile in loading, by means of a chain, a small windlass is fitted on the inside of the left side of the platform, having a spur wheel on its spindle outside the platform, which is driven by a pinion and hand-wheel.

Beneath the centre of the platform a tray to receive the shot truck, when it brings up the projectiles, is fitted, and longitudinally between the sides of the platform in rear there is a tray for holding the side-arms. A buffer block with india-rubber buffers to receive the elevator when run up is attached beneath the second transom of the platform.

The loading stage is similar to that of the 7″, but the centre part is movable on hinges to permit of the shot being hoisted from the truck when wheeled beneath it.

The carriage is designed to admit of the gun firing over a parapet 12′ 6″ high.

## CHAPTER X.—MOUNTINGS FOR R.M.L. 16″ 80 TON GUN, DOVER TURRET.*

Two R.M.L. 16″ 80 ton guns are mounted in the pier turret, Dover, on carriages which run on platforms fixed to the floor. The mountings are fitted with gear for elevating, running back and loading, the whole of which is worked by steam, and which is so arranged that the two guns can be worked either separately or together. The operation of traversing is effected by turning the turret, the gear for which is also worked by steam.

Loading.

To load, the turret is brought into such a position that the two guns are opposite a fixed loading chamber, communicating with the gun floor by two loading tubes below the glacis. The guns are run back to the full extent; they are then depressed to the loading angle of 16°, when the axis of the bore is in prolongation with the axis of the loading tube. The cartridge and projectile are raised in cradles till opposite the lower end of the tube, when they are rammed home by a chain rammer working from the loading chamber.

Steam gear.

For working the gear of the mountings, there is a vertical shaft in the centre of the turret, which is connected by bevel gearing with a pair of vertical direct acting engines, in the engine room at the bottom of the turret. This shaft is always running when the turret is in action, and the gear for each operation, can be connected with it as required by friction disc clutches, similar to those of the traversing gear for 38 ton gun platforms, page 243.

* For further information respecting these mountings see Handbook.

Carriage.

The carriage is of the ordinary heavy garrison type with long low brackets formed by cast iron frames and wrought-iron plates; it runs upon sixteen steel rollers which are permanently in action.

Hydraulic buffers.

The recoil is checked by two hydraulic buffers fixed to the floor of the turret at the front of the platform. The piston rods are attached to the carriage and are drawn out as it moves back. Each cylinder is fitted with taper bars which pass through slots in the rim of the piston, causing the opening for the passage of the oil to gradually diminish towards the end of the recoil, and thus tending to maintain an approximately uniform pressure in the buffer throughout the motion.

The buffers are fitted with adjusting gear so that their action can be regulated to suit varying charges. This gear is similar in principle to the adjusting gear of the buffers in the yoke mounting for the B.L. 12″ described page 286.

Platform.

The platform consists of two girder sides, with a slope of 4°, fixed to the floor of the gun chamber, and connected by a transom in front.

Elevating gear.

The elevating gear is similar to that for the B.L. 12″ gun, page 277. The breech of the gun is supported upon a long guide bar which is pivoted between the sides of the platform at its rear end, and is fitted with a toothed arc at the front. The arc gears with a pinion at the end of a train of gearing which can be connected with the central shaft by a friction disc clutch, put in action by a hand wheel in the gun chamber.

Depressing for loading.

Two rollers attached to the breech of the gun travel along the guide bar during recoil, and at extreme recoil run on to a vertical lift by which the breech can be raised until the gun is at the loading position of 16° depression. This lift is worked by screw and bevel gear, which is connected with the central shaft by a clutch, put into action by a handwheel in the gun chamber.

Running back and brake gear.

For running back and for holding the carriage after recoil and keeping it under control in running out, there is a horizontal steel rack fitted along the outside of each carriage bracket. The rack gears with a large spur wheel attached to the platform, and fitted with a differential brake.

The brake does not oppose the motion of the carriage during recoil, but holds it back and prevents it running out again after recoil, until a lever on the outside of the platform is raised. By means of this lever the carriage can be kept under control in running out. The brakes on both sides of the platform are set up or released by the same lever handle, but the gear is so arranged that the outside brake is released slightly in advance of the inside, and thus the force required to work the lever is reduced.

For running back the large spur wheels are connected with the central shaft through a train of gearing, put in action by a friction disc clutch.

Loading gear.

The loading gear consists, for each gun, of a chain lift for raising the cartridge and projectile from the magazine and shell floor respectively to the loading chamber, and of a chain rammer, coiled in a drum in the loading chamber.

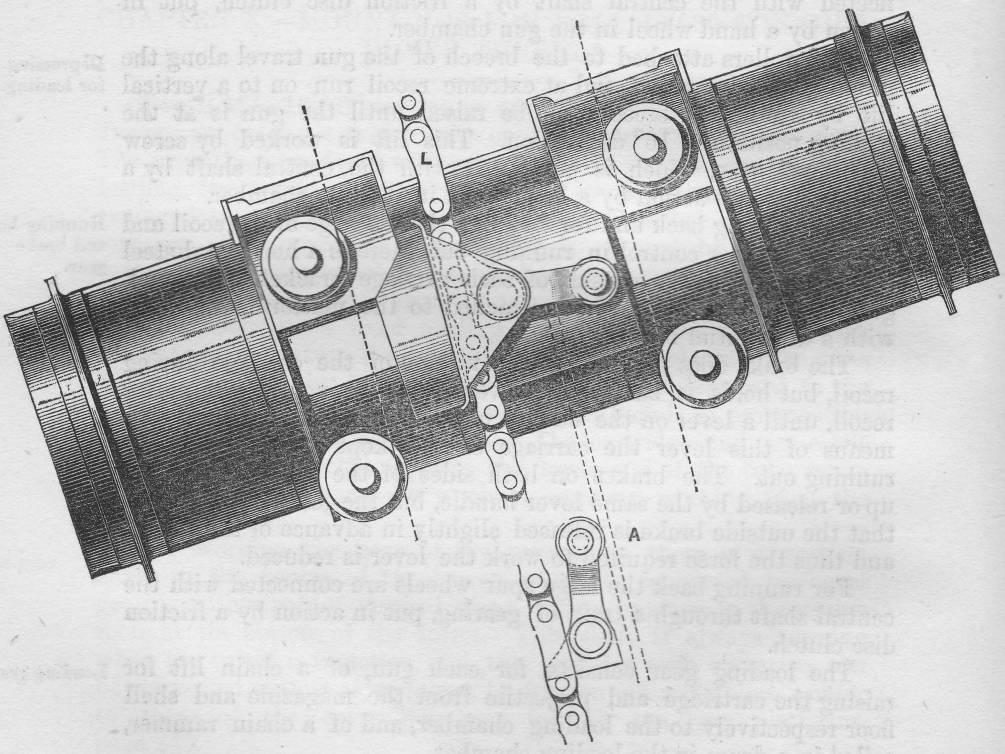
For each gun, two steeply inclined guide bars lead from the

magazine floor to the top of the loading chamber, passing through openings in the floor of the chamber and in the shell floor. At the side of each guide there is an endless chain reaching from the magazine floor to the loading chamber. To these chains the cradle for carrying the cartridge is attached. The cradle, Fig. 77A, consists of an iron cylinder fitted on each side with four metal rollers, which, when the cradle is raised or lowered by the chain, run along the guide bars. The projectile cradle is similar in form, but is not connected with the chains; it is carried up on top of the cartridge cradle. Stops are fitted to retain the projectile cradle at the level of the shell floor, when the cartridge cradle is carried down by the chain.

To load, the cartridge and projectile are placed in their respective cradles, the chains are put in gear with the central shaft, by a clutch worked by a hand wheel in the loading chamber. The cartridge cradle is raised by the chains, and on reaching the level of the shell floor, it carries the projectile cradle up with it. When the cartridge cradle arrives in position opposite the loading tube, it is stopped automatically in the following manner:—

The connection between the cradle and the lifting chain, on each side, is made by a steel tripper, Fig. 77A, pivoted on a gudgeon

Fig. 77A.




at the centre of the cradle. One end of the tripper is formed to engage the chain, the other end is forked and carries a metal

roller. While the cradle is being raised, this roller bears against a fixed guide bar, as shewn at A, which prevents the tripper disengaging from the chain. The guide bar is not continued beyond the loading position, so that, when the cradle arrives opposite the loading tube, the roller being no longer retained by the guide, the tripper pivots on the gudgeon and disengages from the chain.

The roller end of the tripper is now supported on the top of the guide bar, the other or tripping end bears against the pins of the chain, against which the weight of the cradle causes it to press. Only one link of the chain L is long enough to admit the tripper, and, when set in motion to lower, the chain slides freely past the tripper until the long link comes opposite it, when being no longer supported by the pins, it engages the chain, and the cradle is carried down.

The chain rammer is then set in motion by a hand wheel, which acts on a clutch connecting the gear of the rammer with the central shaft, and the cartridge is pushed into the loading tube. The rammer is then withdrawn; the empty cartridge cradle is lowered by the chain, the projectile cradle descending with it until it arrives opposite the loading tube, when it is arrested by hinged pawls. The chain rammer is then put in action and the charge and projectile rammed home. The rammer is then withdrawn, the pawls released, and the cradles lowered together by the chains.

The projectile cradle is attached to a hydraulic brake to prevent any possibility of a sudden fall, should the lifting chain break or the cartridge cradle become disengaged. The brake consists of two hydraulic buffers, one on each side, the cylinders of which are connected by chains with the cradle.

The cartridge cradle is also connected with the projectile cradle by an iron rod on each side, which is fixed to the projectile cradle, and passes through a loop on the cartridge cradle, beneath which it is nutted. When the cartridge cradle is raised by the chain, it slides along these rods until it reaches the projectile cradle; should, however, the chain break or the tripper become disengaged, the cartridge cradle is checked in its descent by a friction brake on the cartridge floor, and if this brake should fail, can only fall freely for the length of the rods, its further descent being checked by the projectile cradle, which is restrained by the hydraulic brake.

Gongs with indicators are fitted to the guide bars on each floor for the purpose of communication. The hammer of each gong is connected with a pointer which works over a metal arc inscribed with the words "lift" and "lower." The pointers on the different floors are connected by link work, so that the descent or ascent of the cradles can be signalled from one floor to the next.

Washing out gear for each gun is fitted in the loading chamber. The gear consists of an accumulator containing water and air at a pressure of 100 lbs. on the square inch, the water being supplied from a pump in the engine room. The accumulator is connected by a bent pipe with an oscillating nozzle, which when in position for use rests in prolongation of the axis of the loading tube. When the gun is at the loading position, by opening a valve in

Washing-out gear.

the pipe connecting the accumulator with the nozzle, a powerful jet of water can be projected into the bore of the gun, thoroughly washing out every part of it.

Locking gear.

The turret is fitted with locking gear arranged to effect the following results :—

(1.) The loading gear cannot be worked from the loading chamber, until the turret is locked in the loading position, and the gun is properly depressed.

(2.) When the turret is locked the handle for starting the engines for traversing cannot be moved.

(3.) When the turret is locked the lift for depressing cannot be lowered, and so the guns cannot be elevated.

(4.) The lift for depressing cannot be worked until the carriage is fully run back.

(5.) The carriage cannot run up while the lift is raised.

The gear for effecting these various results, and which ensures almost absolute protection from accident in carrying out the operations of loading, consists of an intricate system of link work, which is fully described in the Handbook before mentioned.

## CHAPTER XI.—B.L. MOUNTINGS.*

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwt. | qrs. | lbs. | tons. |
| B.L. 12-inch, 43 ton carriage .. .. .. | 162 | 3 | 0 | 5·053 |
| „ „ platform, lower tier .. | 191 | 0 | 0 | 9·579 |
| „ „ „ upper „ .. | 185 | 3 | 0 | 8·847 |
| „ „ yoke .. .. .. | 93 | 3 | 0 | 4·791 |
| 6 inch, Mark V. H.P. carriage .. .. | 295 | 3 | 18 | |

### B.L. 12″ 43 TON. MOUNTING.

In this mounting, Fig. 78, a vertical frame, designated a yoke, is attached to the front of the platform, and to this frame, the piston rods of two hydraulic buffers, which form part of the carriage, are secured. The strain of recoil is thus transferred to rails let into the floor and roof of the casemate in which the mounting is placed, and jump of the platform is thus prevented.

§ 4866.

The carriage consists of two brackets A, A, Fig. 79, connected by transoms.

Each bracket is formed of a single casting of tough steel.

The transoms are formed of plate and angle iron riveted together and attached by screws and rivets to the brackets.

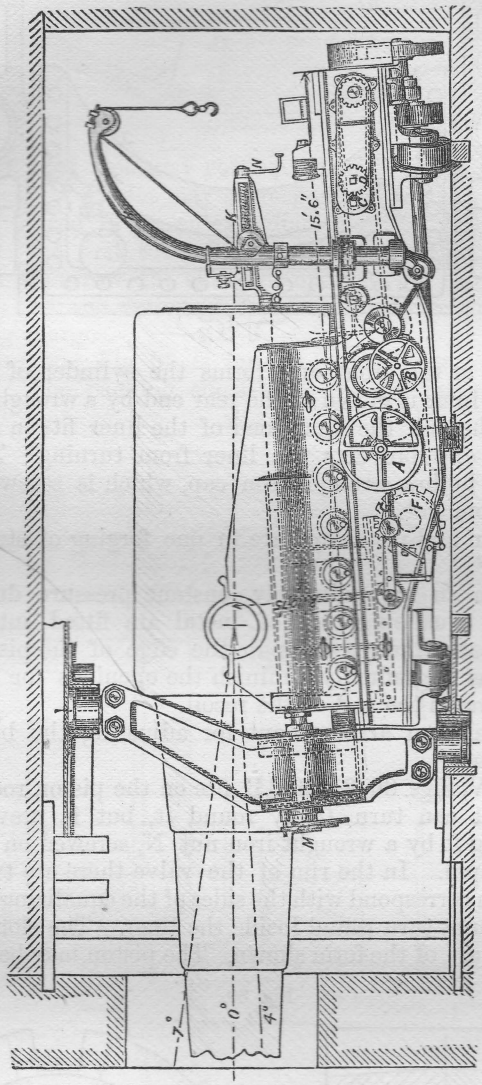
Metal bearings for the trunnions are fixed in the top of the brackets by four screws.

Underneath the bottom plate there is a brake rack, R, formed by two angle iron bars connected by a series of pins.

The brackets are recessed beneath to receive seven pairs of rollers upon which the carriage rests, and which are always in action.

* For 100 ton, 10″, 9·2″ and 8″ B.L. mountings, see Appendix H.

Fig. 78.

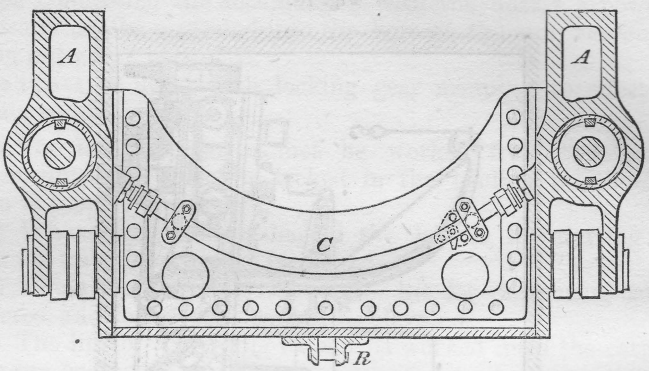



The rollers are steel, 9″ diameter, they are hollow soled, and bushed with P.B.; the bushes being secured in the rollers by screws. The roller axles are steel, 3″ diameter. They rest in wrought-iron eccentric bearings, each of which is secured to the carriage bracket by three screws. Each axle is secured to its outside bearing by a single screw. There is a lubricating channel in each axle closed by a screw plug.

The brackets, Fig. 79, are cast hollow, a bore running lengthways through each. This is closed at the rear end by a wrought iron plug secured by a set screw.

A liner of Whitworth steel 4′ 10″ long and ·75″ thick is fitted

Fig. 79.




into the bore at the front, and forms the cylinder of a hydraulic buffer. The liner is closed at the rear end by a wrought-iron screw cap. A feather on the front end of the liner fits in a keyway in the bracket, and prevents the liner from turning. The liner is secured by a hollow wrought-iron cap, which is screwed into the front of the bracket.

The piston and piston rod are in one forging of steel, diameter of rod 4·254″

To obtain an approximately constant pressure during recoil, two tapered equalising bars of metal are fitted into the liner. These bars pass through slots in the edge of the piston, and are arranged so as to gradually diminish the openings for the passage of the oil towards the end of the recoil.

There is also an arrangement for adjusting the buffer to suit varying charges.

A valve, V, Figs. 80, 81, of P.B. fits on the piston rod in front of the piston, it can turn freely round it, but is prevented from moving along it by a wrought iron nut, N, screwed on the rod and secured by a pin. In the rim of the valve there are two slots, the sides of which correspond with the sides of the equalising bars, so that the valve cannot turn round inside the liner. The slots in the rim of the piston are of the form shown. The piston may be adjusted, so

Fig. 80.

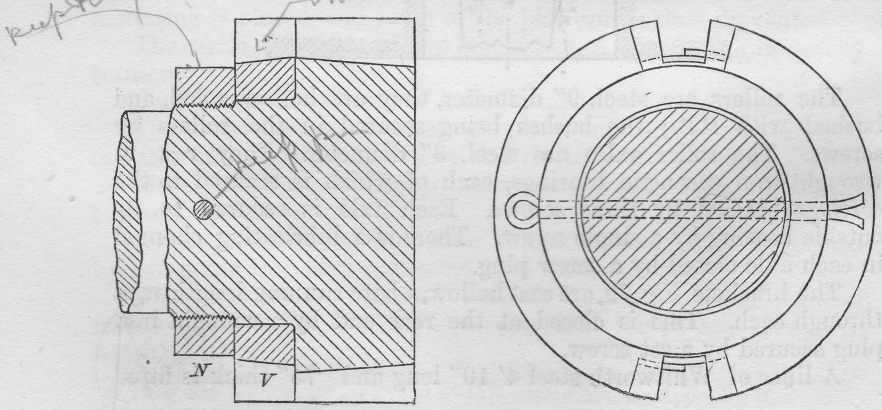
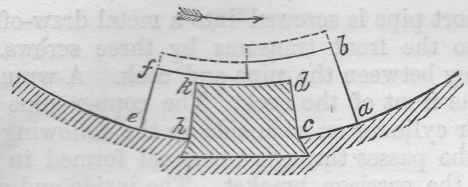


Fig. 81.

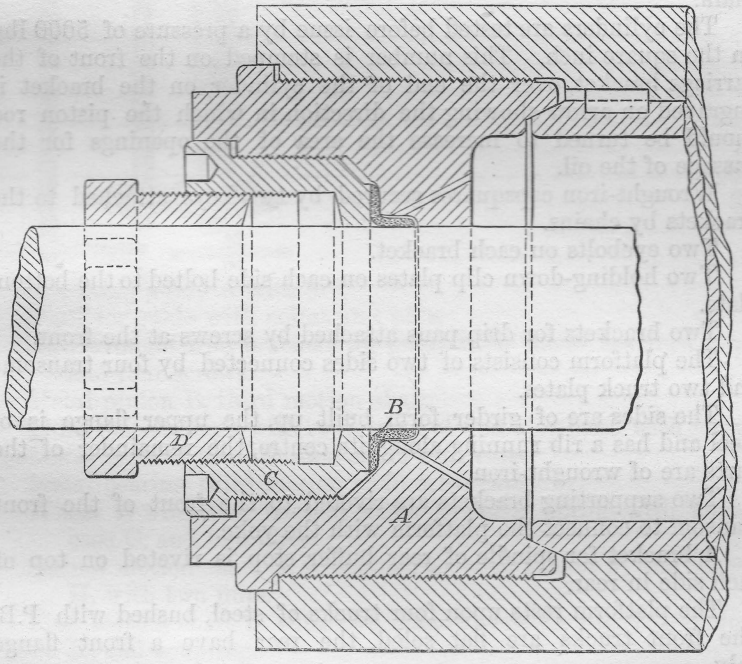



that edges *a*, *b*, of slot may correspond with edges *c*, *d*, of bar, or so that edges *e*, *f*, of slot may correspond with edges *h* *k* of bar, or it may be placed in an intermediate position. By turning the piston from the first towards the second position, that is, in the direction of the arrow, the effective opening for the flow of oil is diminished, and the action of the buffer may be thus adjusted to suit varying charges.

A stuffing box, Fig. 82, is formed in the front cap, A, already mentioned. The packing consists of a cup leather B, kept in

Packing. Fig 82.

Fig. 82.




position by an outside metal gland C, which screws into the cap, and in which there is a recess to hold the packing. This consists of five layers of cotton rope saturated in tallow and secured by an inside metal gland D, which screws into the outer one.

The buffer cylinders are connected in front by a copper connecting pipe C (Fig. 79), which is supported in stays with tail ends passing through the front transom and secured by nuts. The pipe is secured in the stays by capsquares, with leather packings. A short straight pipe is screwed into the bent pipe at right angles to it, and the joint made tight by a leather packing; the front

end of the short pipe is screwed into a metal draw-off cock, which is attached to the front transoms by three screws. There is a leather packing between the pipe and cock. A wrought-iron plug screws into the front of the cock. The copper pipe is connected into the buffer cylinder on each side in the following manner:—A short steel tube passes through a channel formed in the liner and the inside of the carriage bracket. The inside end of the tube is flanged, and fits on a leather ring, in a recess formed in the liner. The outer end of the tube is screwed, and is fitted with a wrought-iron nut, by which it is secured, and by a metal coupling with leather washer. This coupling screws into the union fitted on the end of the copper connecting pipe.

For filling the buffer, a vertical channel passes through the top of each bracket in rear into the cylinder: in this channel is fitted a metal gland, the lower end of which enters the liner, the joint being made secure by a cup leather, the upper end is closed by a wrought-iron screw plug attached to the top of the bracket by a chain.

The cylinders are tested before issue by a pressure of 5000 lbs. on the square inch. This number is stamped on the front of the carriage bracket, over the end of the cylinder, on the bracket is engraved an arrow showing the direction in which the piston rod should be turned to increase the area of the openings for the passage of the oil.

Fittings. Wrought-iron capsquares secured by two keys attached to the brackets by chains.

Two eyebolts on each bracket.

Two holding-down clip plates on each side bolted to the bottom plate.

Two brackets for drip pans attached by screws at the front.

The platform consists of two sides connected by four transoms and two truck plates.

Platform (lower tier). The sides are of girder form built up, the upper flange is of steel and has a rib running along its centre, the remainder of the parts are of wrought-iron.

Two supporting brackets are riveted to the front of the front transom to connect the platform with the yoke.

A bracket for spindle of rear buffer stop is riveted on top of each side in rear.

The platform rests upon four trucks of steel, bushed with P.B. The front trucks are flat soled, the rear have a front flange only.

Diameter of front trucks, 11″.

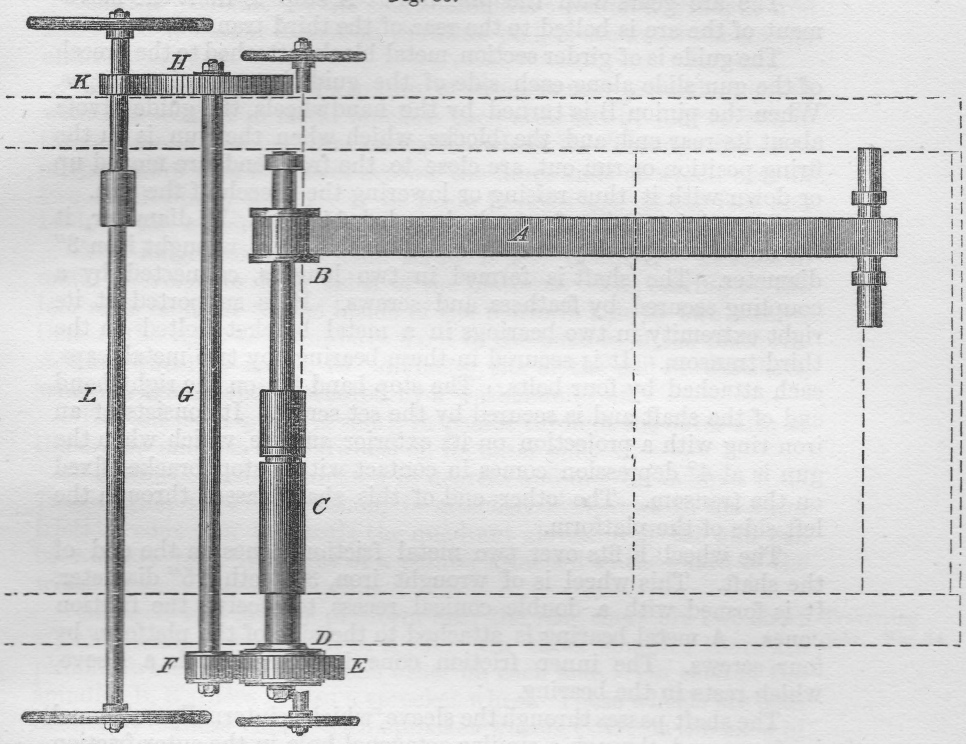
„ rear „ 15″.

The truck axles are of steel 3·75″ diameter, they rest in wrought-iron flanges and are secured by collars and pins. The flanges are bolted to the truck plates.

Gear. The platform is fitted with elevating, traversing, loading, and brake gear, and with an apparatus for withdrawing the breech screw. It is not fitted with running back gear.

The elevating gear, Fig. 83, consists of the following parts:—

Fig. 83.




Elevating gear.

Elevating guide A with arc.
Shaft for guide with collar and pins.
Two wrought-iron brackets for guide with metal bearings, caps and four screws.
Metal pinion B, third motion shaft.
Third motion shaft, with coupling, nut and stop band with screw.
Metal bracket third motion shaft with caps.
Metal bearing third motion shaft with caps.
Wheel E with two friction cones D, spiral spring with metal case C, and two nuts.
Second motion shaft G, wrought-iron, with pinion F, and wheel H, with two nuts.
First motion shaft L, with two handwheels (A Fig. 78), pinion K, and coupling.
Brake, consisting of cramp with bolt, and two screws with collars, nuts and handwheels (B Fig. 78.)
Two metal brackets for cramp.

The elevating guide A is of steel. An iron shaft passes through its rear end, feathers on the shaft fitting in keyways in the guide. A collar is secured by a pin to the shaft on each side of the guide. The end of the shaft rests in metal bearings in wrought iron brackets bolted on the rear truck plate. The brackets have caps secured each by four ·875″ hexagon headed screws.

A steel elevating arc is riveted to the front end of the guide.

The arc gears with the pinion B. A stop to limit the movement of the arc is bolted to the rear of the third transom.

The guide is of girder section, metal blocks attached to the breech of the gun slide along each side of the guide between the flanges. When the pinion B is turned by the handwheels, the guide pivots about its rear end, and the blocks, which when the gun is in the firing position or run out, are close to the front end, are moved up or down with it, thus raising or lowering the breech of the gun.

The pinion B is of metal, shrouded, 11 teeth, 7″ diameter, it fits on an octagonal part of the shaft which is of wrought iron 3″ diameter. The shaft is formed in two lengths, connected by a coupling secured by feathers and screws. It is supported at its right extremity in two bearings in a metal bracket bolted on the third transom. It is secured in these bearings by two metal caps, each attached by four bolts. The stop band fits on the right hand end of the shaft and is secured by the set screw. It consists of an iron ring with a projection on its exterior surface, which when the gun is at 4° depression comes in contact with a stop bracket fixed on the transom. The other end of this shaft passes through the left side of the platform.

The wheel E fits over two metal friction cones on the end of the shaft. This wheel is of wrought iron, 30 teeth, 15″ diameter. It is formed with a double conical recess, to receive the friction cones. A metal bearing is attached to the side of the platform by four screws. The inner friction cone is formed with a sleeve, which rests in the bearing.

The shaft passes through the sleeve, which is internally octagonal in form, and through a similar octagonal hole in the outer friction cone. A nut is screwed on its extremity. The cones are forced into the wheel by a metal adjusting nut on the shaft, which bears against the end of a spiral spring coiled round the shaft, and contained in a metal case, the end of which bears against the end of the sleeve of the inner cone.

The second motion shaft is of steel, 2·75″ diameter, it rests in bearings secured to the sides of the platform, each by four screws. Its left hand extremity is shaped into an octagon on which the steel pinion F, 5″ diameter, 10 teeth, is secured by a nut. This pinion gears with the wheel E. A metal guard for the wheel E and pinion F is attached to the platform side by three screws.

The wheel H, of wrought iron, 50 teeth, 20″ diameter, fits on the right hand extremity of the shaft G, which is also octagonal, and is secured by a nut.

The first motion shaft L, rests in metal bearings attached to the sides of the platform each by four screws (three cheese-headed, and one countersunk). It is formed in two parts united by a wrought iron coupling secured by two keys and two screws. The part of the shaft which passes through the left side of the platform is longer than the other. It is of wrought iron, 2″ diameter. On its extremity a wrought-iron handwheel, 24″ diameter, is secured by a washer and nut. The right hand part of the shaft is of steel, 2″ diameter. A pinion K, 10 teeth, 4″ diameter, is forged on the shaft.

This pinion gears with the wheel H on the second motion shaft.

On the extremity of the shaft outside the pinion a wrought-iron hand wheel, similar to that on the other end, is secured by a washer and nut.

The brake consists of a cramp, of wrought iron pivoted on a bolt with nut secured in metal brackets each attached by four screws to the outside of the platform under the wheel E. Through the arms of the cramp pass two steel screws, the inner ends of which bear on two steel plugs, which can be made to press against the face and back of the wheel E.

The longer or right hand screw is 1·5″ diameter. It rests in metal bearings in both sides of the platform. The bearing on the left side is fixed to the inside of the platform side by two screws, that on the right side similarly fixed to the outside of the platform. A handwheel of metal, 16″ diameter, fits on the end of the shaft, which is square and is secured by a washer and nut.

The left hand screw is short, in passes through the outer arm of the cramp and has a handwheel on its outer end.

A gunmetal scale, graduated in degrees and quarter degrees from 7° elevation to 4° depression, is attached by screws to the outer friction cone; on this scale the quadrant elevation of the gun can be roughly read by means of a pointer attached to the guard of the wheel E.

Traversing gear. Fig. 84.

On each side of the platform near the rear, there are two short winch handle spindles A, B, A′, B′. On these spindles there are pinions which gear with each other on each side. On each of the spindles B, B′, there is also a sprocket wheel. These wheels are connected by endless chains with sprocket wheels C, C′, on the ends of a cross shaft D, at the rear of the platform. On this shaft there is a bevel pinion E, which gears with a bevel wheel F, on a short longitudinal shaft G, which passes through the rear transom and has a spur pinion H on its rear end. The pinion H gears with a spur wheel K, on the end of a longitudinal shaft L, under the platform. On the front end of this shaft there is a pinion M, which gears with a wheel N, on the rear end of a traversing shaft, on the front end of which there is a pinion P, which gears in a cast iron rack in the floor of the work.

The detail of the parts of the gear is as follows:—

Two auxiliary winch handle spindles A, A′, (C, Fig. 78) of wrought iron with spur pinions of 10 teeth, 4″, diameter.

Two winch handle spindles B, B′, (D, Fig. 78) with spur pinions of 20 teeth, 8″ diameter, and sprocket wheels of wrought-iron.

Two endless chains of metal with wrought iron pins.

Two metal brackets for winch handle spindles each with five screws.

Two screws for adjusting chains of wrought-iron each with a nut.

Four brackets of wrought-iron for adjusting screws, each with screws.

Cross shaft D of wrought iron 2″ diameter, with two collars and two screws.

Two metal bearings for cross shaft, each with three screws.

Two sprocket wheels for cross shaft C, C′, of wrought-iron, with feathers.

Bevel pinion E, of metal, 15 teeth 5·968″ pitch diameter, with feather.

Third motion shaft G of steel, 2″ diameter, with cast iron bevel wheel F, 35 teeth, 1′ 1·926″ diameter.

Metal spur pinion H, 10 teeth, 4·818″ diameter, two feathers, washer and set screw.

Fourth motion shaft L of wrought-iron, 3″ diameter, with collar and two set screws, washer and set screw.

Spur wheel K of M.C.I., 55 teeth, 2′ 2·5″ diameter.

Metal spur pinion M, 12 teeth 7·64″ pitch diameter and two metal brackets, each with four ·875″ bolts.

Traversing shaft, wrought-iron collar and two set screws, and three metal brackets.

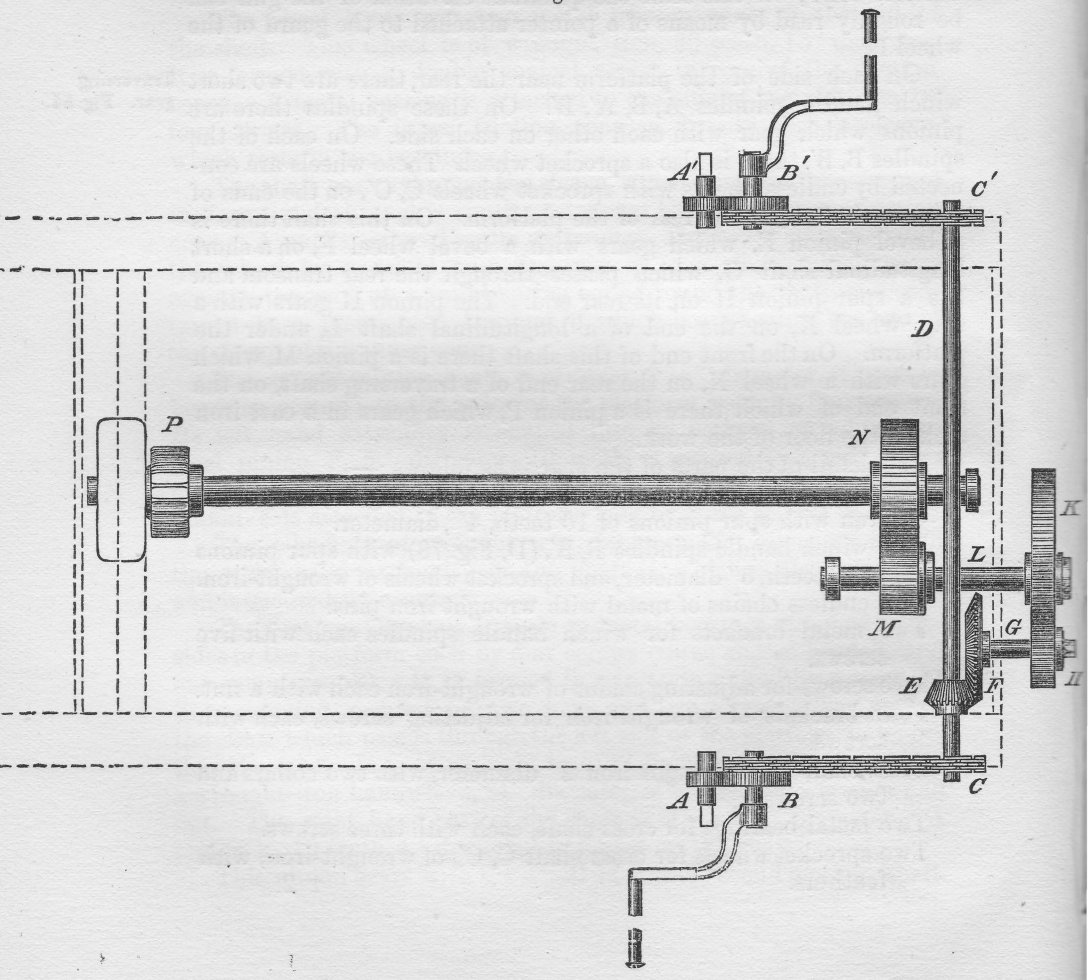
Spur wheel N of M.C.I. 25 teeth, 1′ 3·915″ diameter, with two keys.

Bevel pinion P (E Fig. 78) of metal, 14 teeth, 10·025″ greatest diameter, with two keys.

Two metal guards for sprocket chains and wheel, each made in two parts, each part with four screws.

Metal guard for pinion and wheels H and K, with five screws.

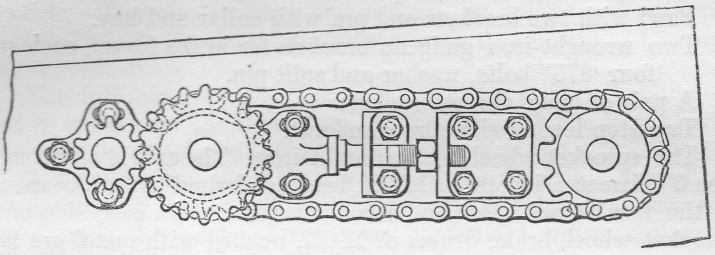
Fig. 84.



Pointer, hinged, of wrought-iron tipped with steel with two screws.

The bracket Fig. 85, for support of the winch handle spindles on

Fig. 85.



each side has elongated slots in it for five screws by which it is attached to the outside of the platform.

Two bearings are formed in each bracket in which the inner ends of the winch handle spindles rest, their outer ends resting in bearings formed in the guard, which is attached to the bracket by screws passing through elongated slots.

The cross shaft is supported in bearings attached to the outside of each side of the platform, and also in bearings formed in the guards. It is secured by a collar fixed on each end, outside the guards by a screw. The rear sprocket wheels fit on this shaft on each side, between the sides of the platform and the guard.

The adjusting screws rest in wrought-iron brackets attached to the sides of the platform between the sprocket wheels on each side. By turning a nut on the screw, the head of the screw can be made to bear against the bracket supporting the winch handle spindles and force it towards the front, thus tightening the endless chains.

The bevel pinion E is secured on the cross shaft D.

The third motion shaft G rests in a metal bearing in the rear transom above the truck plate. The bevel wheel F is secured on the front end by two steel feathers, wrought-iron washer and set screw, and the pinion H is secured on the rear end by a steel feather.

The fourth motion shaft L rests in bearings in brackets of metal bolted underneath the rear truck plate, each by four bolts.

The spur wheel K is secured by two feathers on the rear end of the shaft, and the pinion M by two feathers on the front end.

The traversing shaft rests in metal brackets, bolted, one underneath the rear truck plate, one underneath the second, and one in rear of the third transom.

The wheel N is secured by two keys on the rear end of the shaft and the pinion P is similarly secured on the front end.

The pointer is fixed by two screws underneath the left side of the platform in front of the rear truck plate.

This gear consists of the following parts :— Brake gear.

A sprocket wheel (F Fig. 78) with axle and two brake drums of cast-iron attached by six ·875″ bolts.

Two brake bands of steel with wrought-iron sockets.

Brake band lever with two steel pins 1″ diameter and two split pins.
A cross shaft of steel 2·25″ diameter.
Two levers for cross shaft, two links, two brake levers G with handles and counterweight, and four link connecting pins, each with a nut and split pin.
Pawl with two brackets and pin with collar and key.
Two wrought-iron gudgeon brackets for brake levers, each with four ·875″ bolts, washer and split pin.
A pair of metal thrust brackets.
Two stop levers with screw and nut.

The sprocket wheel is of wrought-iron. The axle is of wrought-iron 3″ diameter, it rests in M.C.I. bearings bolted to bars connected to the front truck plate and second transom. On each side of the sprocket wheel, brake drums of M.C.I. bushed with metal are fixed by six ·875″ bolts, over which the brake bands pass. One end of each band screws into a socket pinned to the short arm of the brake band lever, the other ends of the bands are pinned to the long arm of the lever. For lubricating the axle of the brake wheel, a metal pipe leading to a channel in the boss of each brake drum is secured at the side of each drum by a metal band attached to its rim by screws.

The brake band lever is keyed to the cross shaft, which is of steel 2·25″ diameter. It rests in metal bearings bolted to the sides of the platform, and in metal brackets attached to the bars supporting the brake drum axle. The thrust brackets fit on the cross shaft and take a bearing against the brake drums.

A wrought-iron lever is keyed and pinned on each end of this shaft. Each lever is connected by a wrought-iron link with a wrought-iron brake lever. The brake levers pivot on flanged gudgeon brackets, attached to the platform side each by four screws. The levers are secured on the gudgeons by washers and pins. A cast-iron counter weight is attached to each lever by a bolt and nut.

A wrought-iron pawl for the brake lever fits on a wrought-iron pin secured by a collar and key in two wrought-iron brackets, attached to the sides of the platform by four ·625″ screws.

A stop is fitted to each end of the cross shaft, to limit the action of the brake.

The stop consists of a short lever keyed on the shaft, under the sides of the platform; a bolt with nut passes through the end of the lever and can be adjusted so as to bear against the lower flange of the platform sides, when the brake has come sufficiently into action.

Loading gear.

The loading gear consists of the following parts :—
A derrick H, Fig. 78, with three sheaves and fall with hook.
A windlass with shaft and spur wheel I.
A pinion with spindle L.

The derrick is formed in two lengths, the lower length is tubular and is shrunk on the upper which is solid. It rests in two metal brackets, attached each by six bolts to the outside of the left side of the platform, just in front of the traversing winch handle. The top bracket is recessed on the upper surface, and there is a similar recess in a bearing on the derrick; in this recess 28 steel balls, ·625″ diameter, are placed in order to reduce the friction. The

sheaves are of metal 7·875″ diameter. They revolve on wrought-iron pins 1″ diameter, held one in the top of the derrick, which is forked; one in two wrought-iron brackets, fixed each by three screws about the centre of the derrick; and the third in a metal bracket, which forms part of the lower bearing for the foot of the derrick. The sheave pins are secured by collars and split pins. A metal cap is fitted by four screws over the sheave at the top of the derrick.

The fall consists of 3″ rope, 24′ 6″ long, with a hook at one end, it is led over the two upper sheaves, through the lower part of the derrick, under the lower sheave and round the windlass.

A wrought-iron lever handle to turn the derrick is hinged to a pin secured by a split pin in a band, attached by three screws to the derrick, the hinge of the lever contains a spring and piston, covered by an iron plate with three screws, two flats are made on the pin, and the lever is kept in a vertical or horizontal position by the piston pressing on one side or other of the flats.

The windlass is cast-iron, it fits on the outer end of a short shaft of wrought-iron 2·5″ diameter, which rests in a metal bearing in the left side of the platform, secured by four screws. On the inner end of the shaft is a M.C.I. spur wheel, 55 teeth, 21·884″ diameter, secured by two feathers, a washer and set screw. The windlass is secured on the shaft by a feather, washer and set screw.

The pinion spindle passes through the side of the platform in rear of the windlass, and rests in metal bearings fixed to outside and inside of side by four screws. On the inner end of the spindle is forged a wrought-iron pinion, 9 teeth, 3·58″ diameter, which gears with the cast-iron wheel. This spindle is placed in position from the inside of the platform and secured by a collar and set screw. Its outer end is squared to take a winch handle.

### Apparatus, Withdrawing Breech Screw K, Fig. 78.

Apparatus, withdrawing breech screw.

This apparatus consists of the following parts:—
An arm of wrought-iron with collar and nut.
Bracket for arm of metal.
Seventeen balls, revolving, steel ·625″ diameter.
Collar, packing arm (for Mark I gun only).
Screw, withdrawing, wrought-iron, with collar and nut.
Bracket, metal, screw, withdrawing, with guide locking bolt.
Handle, screw, withdrawing, iron.
Lever, catch, steel, with pin, collar, and key.
Spring lever catch.
Bolt, adjusting, spring lever catch, iron, with pin and key.
Bracket for bolt, adjusting, with screws.
Locking bolt of steel with nut.
Bracket for bolt of metal.
Handle for bolt of wrought-iron.
Plug, jamming bolt, of steel.
Spring for plug.
Screw, adjusting, for spring.
Bracket retaining arm of metal, with bolt, lever handle, spring.
Plate, packing, metal (for Mark I gun only).

The arm is of H section, with a steel fish plate riveted on each side of the web, it is bent to about a right angle, one part is vertical and pivots in a bracket attached to the right side of the platform, just in front of the winch handle of the traversing gear. The arm revolves on the steel balls, which lie in a groove in the packing collar. This collar is only used with the Mark I gun, and fits on the top of the bracket. At the end of the horizontal portion of the arm a wrought-iron forging is riveted, upon which the bracket for the withdrawing screw is secured. This bracket consists of gun metal; it is formed with bearings at each end in which the withdrawing screw rests. The guide for the locking bolt is attached by screws to the top of the cradle, its ends forming caps for the bearings of the screw, which is secured in position by a collar and nut, the latter also securing a handle on its rear end. The lower part of the cradle is formed with a socket, which fits over and rests upon the forging at the end of the arm. A square projection on the forging enters loosely a hole in the cradle; the end of the projection is screwed and takes a washer and nut, which secure the cradle, but allow it a slight play. A buffer, consisting of an iron spindle, with head and india-rubber ring, is secured by a nut at the front of the cradle.

The metal bracket for the locking bolt forms a nut for the withdrawing screw, and travels along it between the sides of the guide, when it is turned. The locking bolt, which has a tee head, pivots in the upper part of the bracket, and has a handle on its rear end, secured by a nut. For use, the head of the bolt is made to enter a recess in the breech screw; it is prevented from disengaging, unless the handle is turned, by the jamming plug which is pressed by the spiral spring against a square formed on one side of the shank. The plug and spring fit in a recess in the right side of the bracket. The adjusting screw is screwed into the outer end of this recess and bears on the spring.

The catch lever is a steel lever formed with three arms, two horizontal and one vertical, which is secured by a collar and key on a pin held in the lower part of the cradle at the front. The front horizontal arm of the lever is formed with a hook which engages with a corresponding hook screwed to the gun, and is kept in action by a spring. The spring is attached to the end of the vertical arm of the lever, and to the adjusting bolt, which is secured by a nut in a small metal bracket attached to the outside of the cradle. The rear horizontal arm of the lever is formed as a handle.

When the locking bolt and catch lever are both engaged, the breech screw can be withdrawn, by turning the withdrawing screw by the handle at its extremity

The arm carrying the cradle is retained out of action, when turned to the rear of the platform, by a bolt acted on by a spring working in the retaining bracket, which is fixed by screws to the rear of the buffer stop bracket. There is a lever handle on each side of the bracket for releasing the bolt.

Fittings.

Rear buffer stops are bolted to brackets on top of each side in rear. Each stop consists of a wrought-iron spindle with head and

nut, seven parting plates of wrought-iron ·125″ thick, 7″ diameter and eight rings of india-rubber ·5″ thick and 6″ diameter.

Eyebolts on each side in front and rear.

Two wooden steps with iron attachments on the rear of the platform.

Platform (upper tier).

The platforms for the upper and lower tiers are the same in general construction, but differ in the position and dimensions of the rear trucks which in the upper tier are 15·5″ diameter, and are placed 3′ 2″ further towards the front of the platform. In the upper tier platform there is a cast-iron bracket for the windlass spindle of the loading gear, instead of a metal bearing. There are also two front and two rear brackets of cast-iron for the rear flanges, which are not required in the lower tier platform.

## The Yoke.

The yoke.

The yoke consists of two vertical cast steel brackets, connected at top and bottom by distance pieces of cast steel, through each of which pass two wrought-iron bolts. Diameter of upper bolt 2·5″, of lower 3″. They are also connected a little below the centre, by a trough-shaped built-up transom of wrought-iron attached by screws.

At the upper and lower end of each bracket is a steel roller 11·9″ diameter, bushed with P.B on a vertical pin of 5″ diameter, which forms part of the bracket casting, a metal collar being placed on the pin below the roller.

The lower rollers are secured on their pins, which are 6″ diameter, by wrought-iron nuts, collars being placed between the rollers and nuts.

These rollers run along wrought-iron recoil rails, let into the floor and roof of the work.

The yoke is attached to the platform by two pins 3″ diameter, which pass through brackets on the front transom of the platform, and through brackets bolted under the transom of the yoke. Buffer stops are fitted to the rear of the yoke. Each stop consists of a wrought-iron bracket and five ·75″ bolts, wrought-iron buffer spindle, washer and two nuts. Seven wrought-iron parting plates. Eight india-rubber rings.

The front ends of the piston rods of the hydraulic buffers of the carriage pass through holes in the yoke brackets and are secured in front, by steel nuts, and in rear by a wrought-iron nut. To facilitate the withdrawal of the piston rods, the holes in the yoke are elongated in rear. After the rods have been placed in position wrought-iron stop plates are secured over the openings in rear by three ·75″ screws.

Adjusting gear.

Adjusting gear, Fig. 86, consisting of the following parts:—

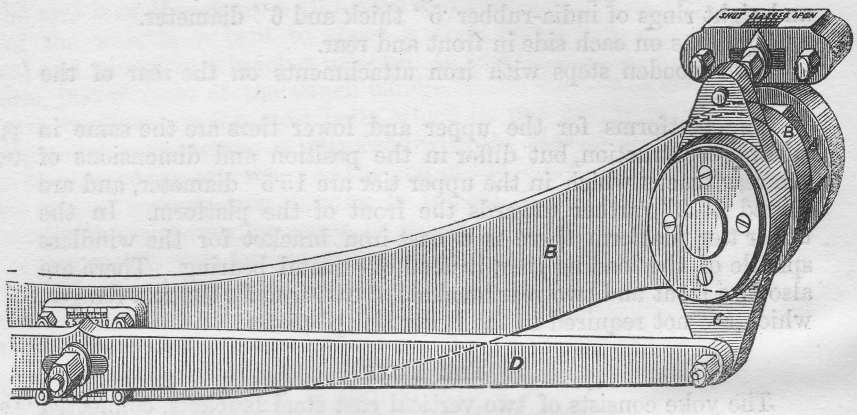
Wrought-iron connecting plate B.

Wrought-iron connecting rod D with steel pin, with collar and nut.

Two wrought-iron adjusting levers C (M Fig. 86) with ·5″ square steel key and two metal pins.

Metal indicator plate for connecting rod with four ·5″ bolts, and a 1″ bolt and nut.

Fig. 86.




Two metal indicator plates for adjusting levers, each with two ·625″ screws, hexagon head, and one steel screwed pointer with stud and nut.

The steel nut A is screwed on the end of the piston rod, and secured by a ·5″ taper steel pin. The front nuts on each piston rod are connected by the wrought-iron curved plate B, which fits over cylindrical surfaces formed on the nuts, so that the nuts can be turned freely without affecting the bar.

On each nut in front of the bar B fits a wrought-iron adjusting lever C (M, Fig. 78). The lever is keyed to the nut by a feather let into both, and is secured by a wrought-iron washer attached to the end of the nut by four screws. The lower ends of the two levers are united by a wrought-iron connecting rod D, the ends of which are bolted to the levers. This rod lies just in front of the bar B, and is connected with it by a bolt which passes through a metal plate, attached to B by four bolts, and through an elongated slot in D. If a nut on the front end of this bolt be sufficiently loosened, the rod D can move through a certain distance laterally, and will thus turn the lever C, and so the nuts A and the piston rod and piston. By tightening the nut on the bolt, the rod may be clamped in any position desired.

A scale is engraved on the metal plate attached to the bar B, and a pointer is formed on the rod D.

This scale is divided into six equal intervals, which are numbered from 0 to 6, and are each subdivided into four smaller equal intervals. These intervals do not represent any particular linear dimensions, but merely serve to indicate the relative amount of opening for the oil in the piston.

As an additional security that the piston rods may be always in correct adjustment, there is also a separate clamp with scale attached to each lever C. Each consists of a steel stud passing through an elongated hole in the upper end of the lever, and through another elongated slot in a plate attached to the yoke. A pointer is fitted on the stud, and a scale is engraved on the bracket similar to that on the bar B. The stud is clamped by a nut in front of the pointer, and when so clamped, the piston rods cannot be turned.

## B.L. 6″ Mark V. H.P. Carriage.*

The carriage consists of the following parts:—

| | |
|---|---|
| 1. Elevator .. .. .. .. .. | Plate XLVII. |
| 2. Platform .. .. .. .. .. | |
| 3. Hydro-pneumatic cylinder and ram.. .. | Plate XLIX. |
| 4. Elevating gear .. .. .. .. | Fig. 87. |
| 5. Cut-off gear .. .. .. .. .. | Plate XLVIII. |
| 6. Air pump .. .. .. .. .. | Plate L. |

Elevator.

The elevator consists of two steel brackets A, connected by steel transoms. At the lower end of each elevator is a wrought-iron pin R, upon which it oscillates, and at the other ends are bearings for the gun trunnions. About the centre of the elevator is a cast steel crosshead K, which is attached to the recoil ram J by means of a socket and cotter.

The object of this carriage is to elevate the gun from the loading position under cover of the parapet to the firing position over the parapet, or *vice versâ*. The retaining chains P, are attached to brackets on the lower carriage, and to bolts on the elevator, and limit the stroke of the ram, thus preventing the gun being carried too far forward.

The carriage admits of 15° elevation and 5° depression.

Platform.

The platform is made up of two steel girders or cheeks, A, A, which are connected by a steel transom, C, C, at the front, and B, B, at the rear. The platform is mounted on four steel trucks S, which run on a steel racer X, fixed to the masonry. A buffer N is fitted on each cheek, which will act as a cushion, in case the recoil of the gun is excessive. A steel pocket is bolted to the inside of each cheek to receive the trunnions of the hydro-pneumatic cylinder H. On the underside of the platform are fitted steel clips Z at the front and rear, which engage a clip racer Y fixed to the concrete. Two elevator brackets Q are fitted to the front of the carriage, in which rock the pins R of the elevator.

A sighting ladder and platform △ is provided for use in sighting with the ordinary service sights, the platform is fitted with a hinged foot-plate which is brought into a vertical position by means of a spring after use, thus keeping it clear of the gun when ascending and descending.

An overhead shield △ J, supported on eight pillars △ H, is supplied. These pillars rest in sockets K K, L L, M M, on the lower carriage.

Cut-off gear. Plate XLVIII.

This gear is provided to close the by-pass or elevating valve, when the gun is in firing position, thus preventing an undue strain on the check chains P. When the gun ascends into firing position the valve is closed by means of the cord, which is attached to the elevators, and to the crank lever, Q Q Q, on the elevating valve spindle, O O O. The handle should be pulled from the carriage when the gun is in firing position, to ensure the valve being perfectly closed.

Hydro-pneumatic cylinder. Plate XLIX.

The hydro-pneumatic cylinder, H (see Plate XLIX), has two chambers; one "a" is the recoil cylinder, and contains the recoil

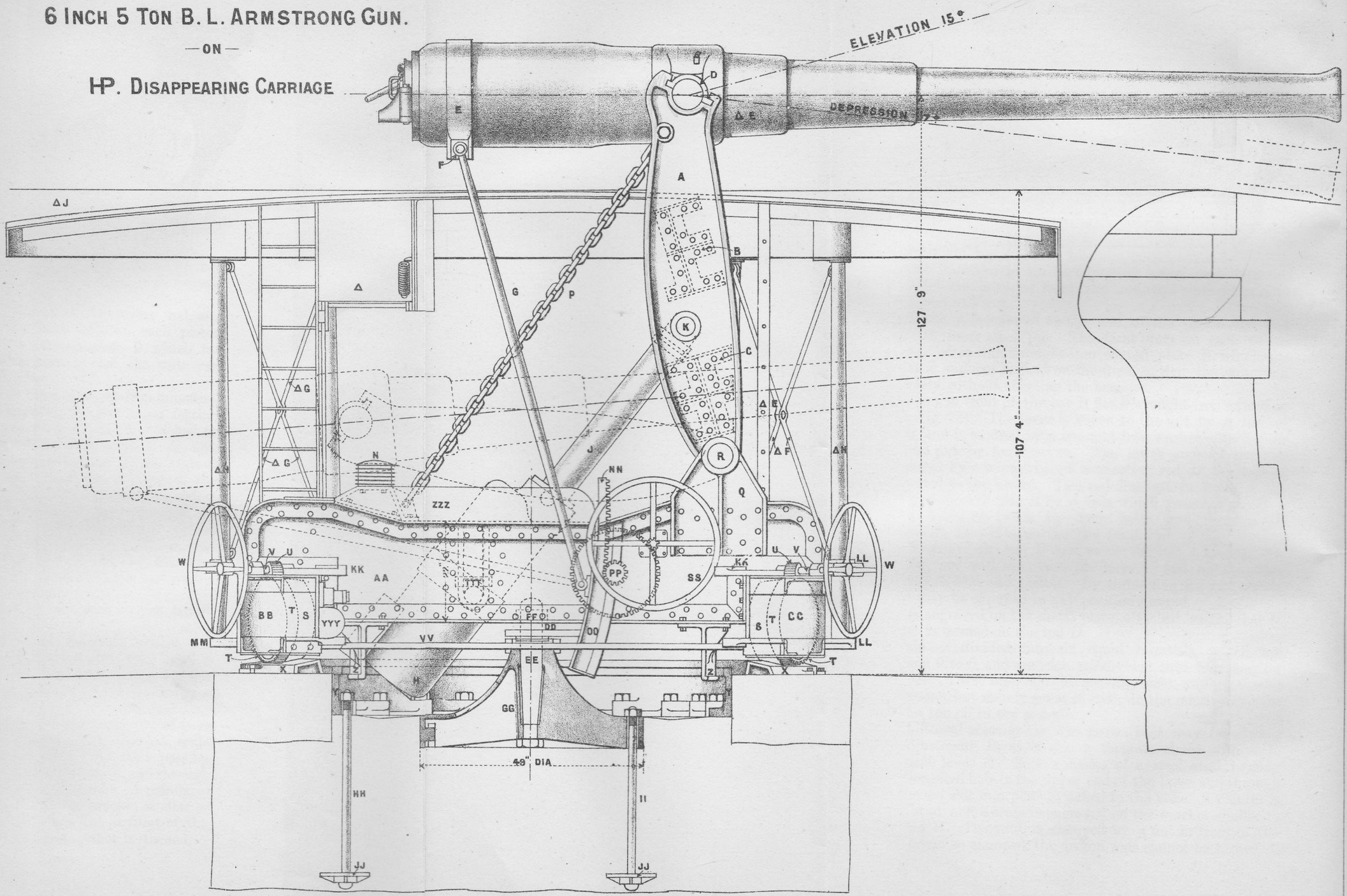
* For other H.P. mountings for Marks IV and V guns, see Appendix H.

# ELEVATION.

## 6 INCH 5 TON B. L. ARMSTRONG GUN.

—ON—

## HP. DISAPPEARING CARRIAGE

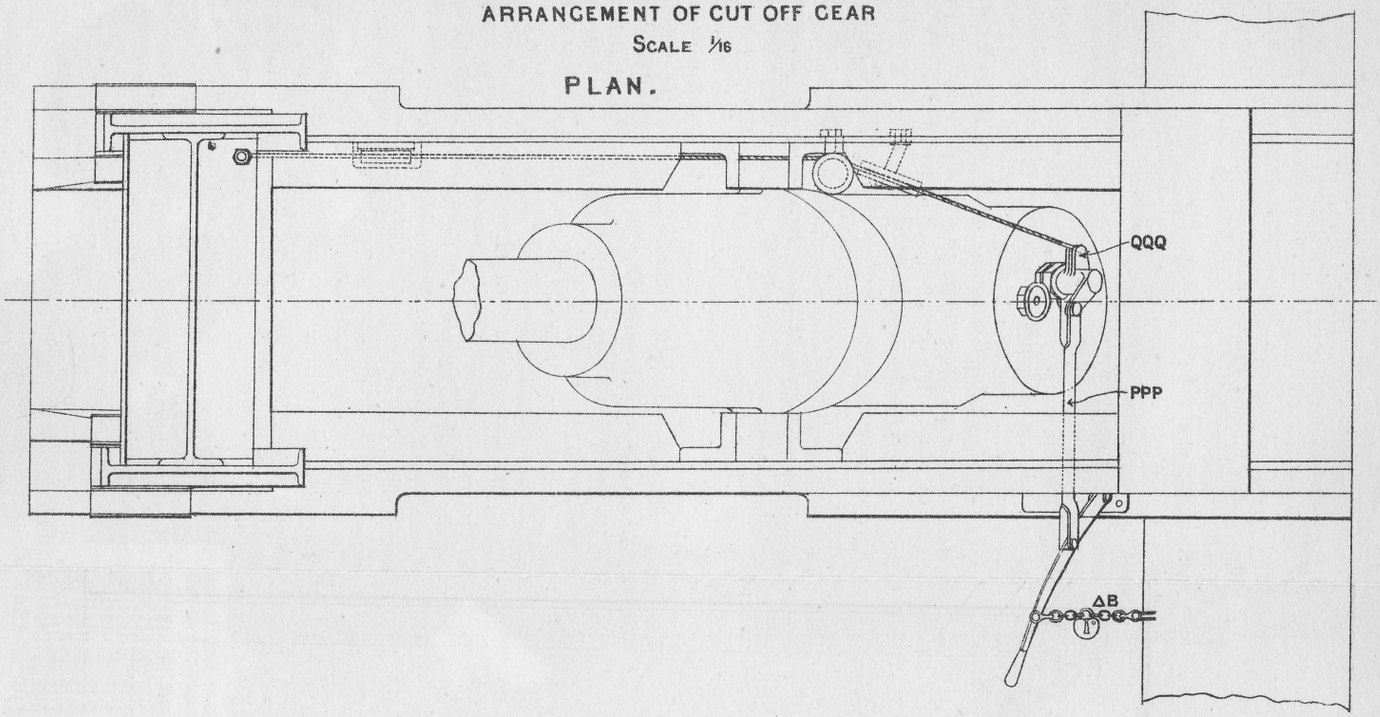



DANGERFIELD. LITH. 22, BEDFORD ST. COVENT GARDEN. 12453.

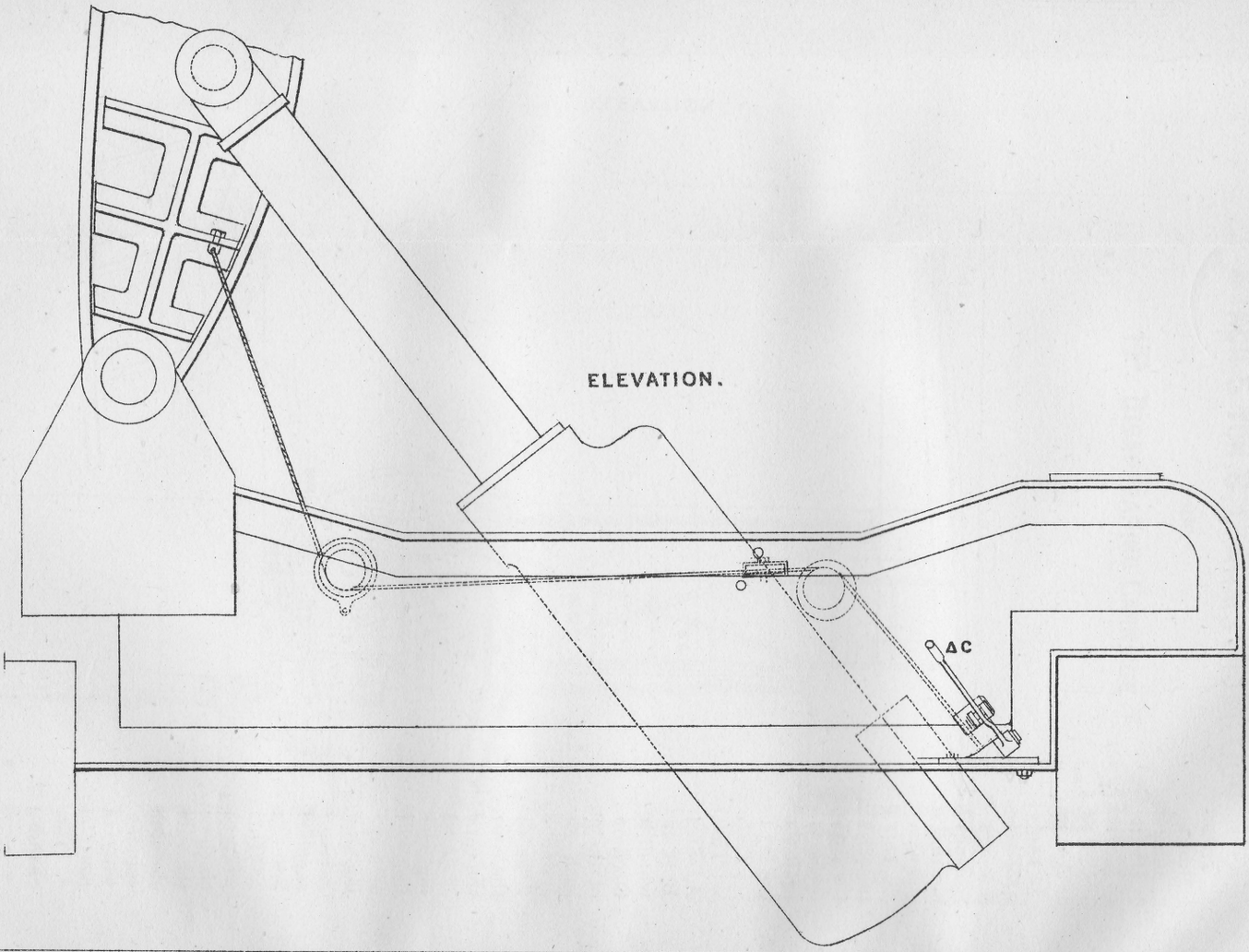
## ARRANGEMENT OF CUT OFF GEAR

SCALE 1/16

### PLAN.




### ELEVATION.




DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 12455.

ram J ; the other "b" is the chamber for containing the necessary supply of water and air. These two chambers are connected by two recoil valves J J J, and K K K, and a by-pass or elevating valve, access to the former being obtained by a wrought-iron cover M, secured with eight studs, and jointed by a leather ring. In this cover are two tapped holes for eyebolts, for convenience in lifting it. At the bottom of these holes is a smaller hole, connected to an annular channel immediately over the leather joint, the object of which is to allow any water which may pass the joint to escape, thus preventing it from exerting any additional stress on the bolts, by acting on a larger area. When water is observed escaping from this hole, it is a proof that the cover M, is not tightly fastened down. The top end of the recoil cylinder is fitted with a packing gland, which consists of the following parts:—

A gun metal ring, carrying the cupped leather ring, is fitted into a recess prepared for it, over this cup leather ring is placed the gun metal gland, containing a recess for spun yarn packing which is tightly compressed by a screwed gun metal ring. The object of the cup leather ring is to prevent the escape of water, when the pressure is high, and that of the spun yarn packing, to prevent its escape when the pressure is low. There is also a flat leather ring, to prevent the escape of any water which may pass outside the cup-leather ring.

On the left hand side of the air chamber is a filling cock, G G G, the pressure pipe from the pumps is attached to the nozzle *m*, the plug *n* is raised, and the water or air pumped into the chamber. When the pumping is finished, the plug *n* is screwed down, and the pumps can be disconnected from the cylinder. An air cock, H H H, is inserted on the top side of the cylinder.

The action of the hydro-pneumatic cylinder is as follows:—

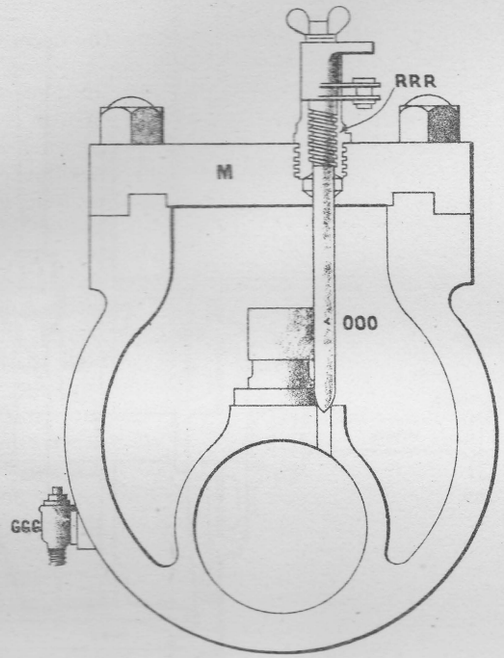
The requisite quantity of water having been pumped into the chamber, air is then pumped in to a pressure of 1,350 lbs. per square inch. The only means of entrance for the pressure from the chamber "b" to the recoil cylinder "a" is through the by-pass valve, this being opened, the compressed air forces the water behind the ram J and so pushes the ram out, thus raising the gun to the firing position. The by-pass valve is now shut, and the water in the cylinder has no way of return into the chamber except through the recoil valves.

The pressure of the air in the chamber, when the gun is up, will be found to be reduced to 570 lbs. per square inch. When the gun is fired the force of recoil presses back the ram J, expelling the water through the recoil valves.

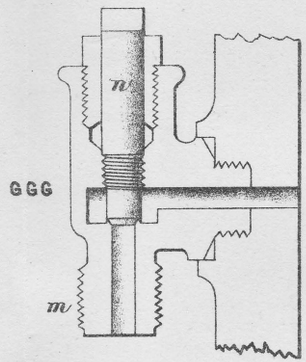
Before charging the cylinder for service it is advisable to partially charge it, and allow the pressure to act on the cupleather in the gland for some little time, the longer the better. This softens the leather and keeps it tight. When the cylinder is once properly charged any slight leakage can be made good by the use of the air pump.

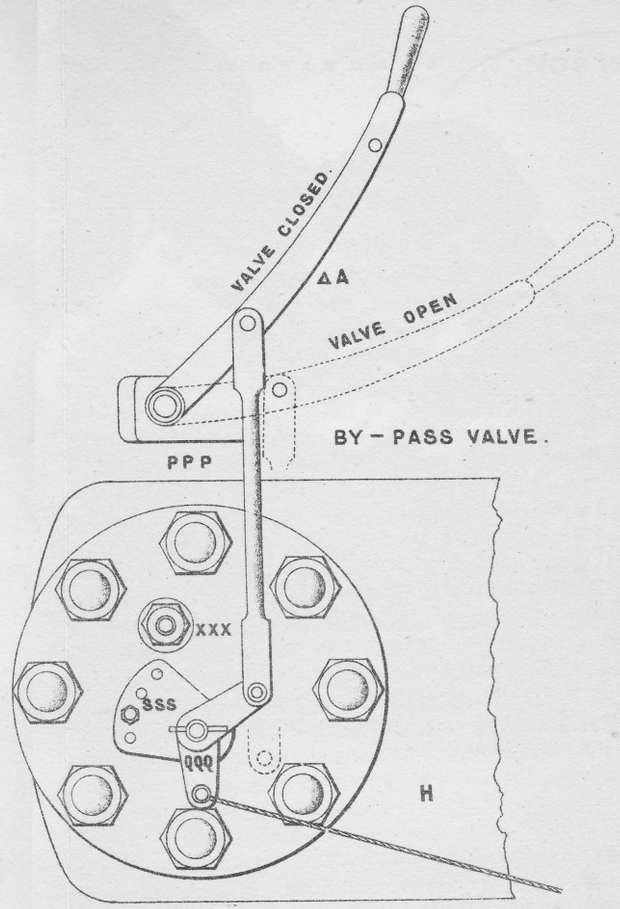
Elevating gear. Fig. 87.

The elevating gear is fitted on both sides of the platform, and is worked by means of a handwheel, S S, on the right side. The handwheel is fixed on the spindle V V V, which passes through a



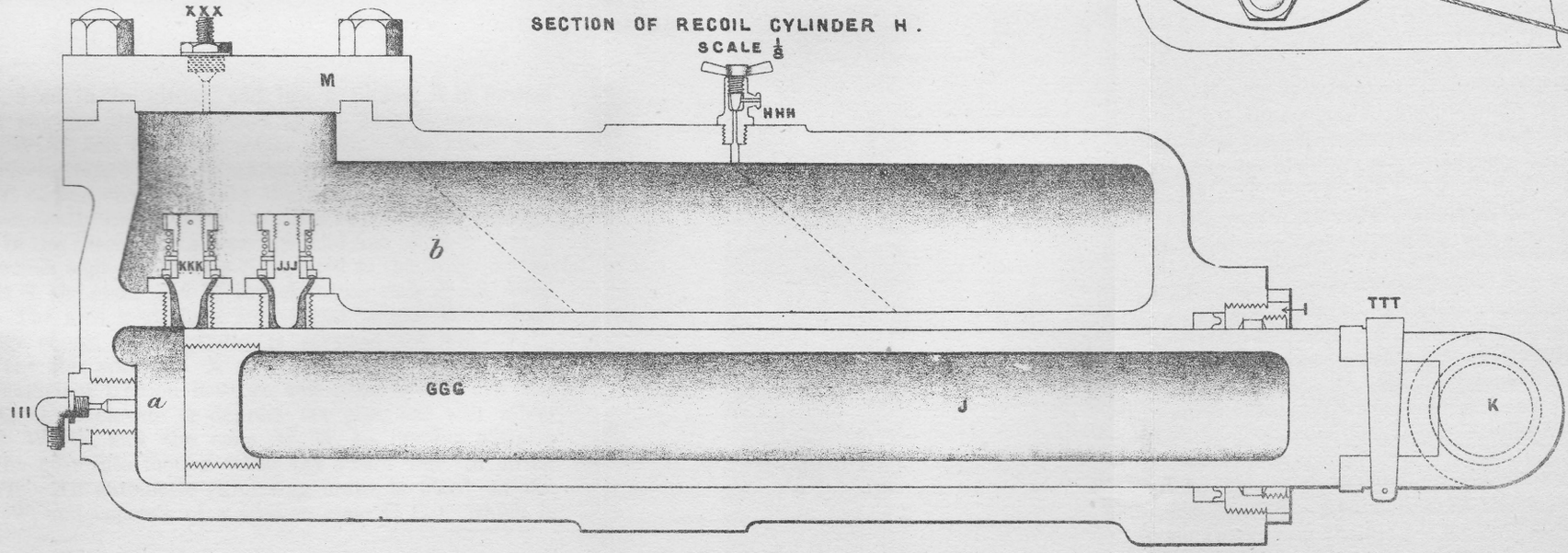

FILLING COCK.




SECTION OF RECOIL CYLINDER H.

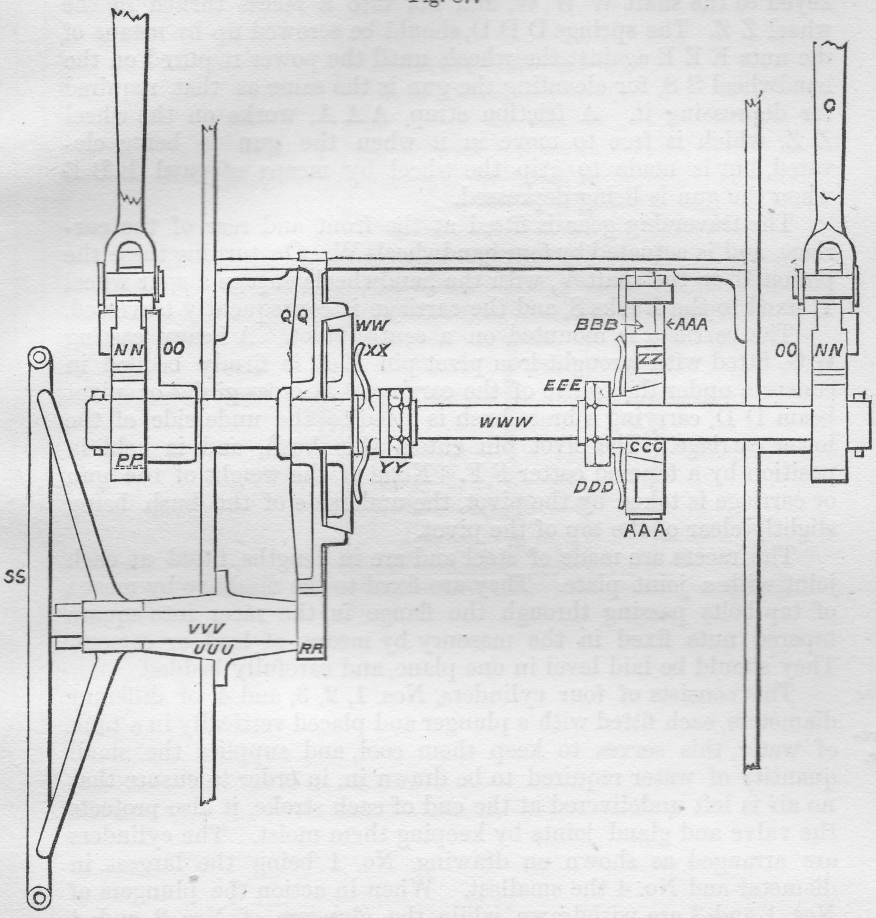
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DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDE.

12453

Fig. 87.




bush U U U, fixed in the girder, and has a pinion, R R, formed on it, which engages the spur wheel Q Q. This is carried on the shaft W W W, but is free to rotate on it. The inner face has a coned recess turned on it, in which the friction cone W W fits. The part of the shaft carrying the cone is hexagonal, and the cone consequently rotates with it. The shaft passes through bushes fixed in the cheeks of the carriage, and has at each end a pinion P P, which engages the arcs N N, fixed to the ends of the elevating rods G, the other end of the elevating rods being fixed to the gun. The arcs work in a gun metal guide, O O, fixed to the carriage cheek. The spindle is screwed for nuts Y Y, which force the star spring X X against the face of the cone. This causes sufficient friction between the cone W W, and the spur wheel Q Q, to elevate or depress the gun, but will allow the shaft W W W, and the cone W W, to revolve without putting all the gear into motion when the strain due to firing comes upon it. An automatic regulating brake is fitted on the shaft W W W, and consists of a friction cone C C C which is

keyed to the shaft W W W, and fits into a recess turned in the wheel Z Z. The springs D D D, should be screwed up by means of the nuts E E E against the wheels until the power required on the handwheel S S, for elevating the gun is the same as that required for depressing it. A friction strap, A A A, works on the wheel Z Z, which is free to move in it when the gun is being elevated, but is made to grip the wheel by means of pawl B B B when the gun is being depressed.

Traversing gear.

The traversing gear is fitted at the front and rear of the carriage, and is actuated by four handwheels W. On turning these the pinion U on the shaft V, with the handwheels engage a spur wheel T, fixed to the trucks S, and the carriage is consequently traversed.

Pivot.

The carriage is mounted on a centre pivot. A heavy casting G G, fitted with wrought-iron pivot pin E E, is firmly bedded in concrete under the centre of the carriage. A cross girder or pivot beam D D, carrying a brass bush is fitted to the underside of the lower carriage. The pivot pin enters this bush, and is held in position by a tapered cotter F F. None of the weight of the gun or carriage is taken by the pivot, the underside of the bush being slightly clear of the top of the pivot.

Racers.

The racers are made of steel and are in lengths, fitted at each joint with a joint plate. They are fixed to the masonry by means of tap bolts passing through the flange in the racer into square tapered nuts fixed in the masonry by means of lead or cement. They should be laid level in one plane, and carefully bedded.

Air pump for hydro-pneumatic recoil cylinder. Plate L.

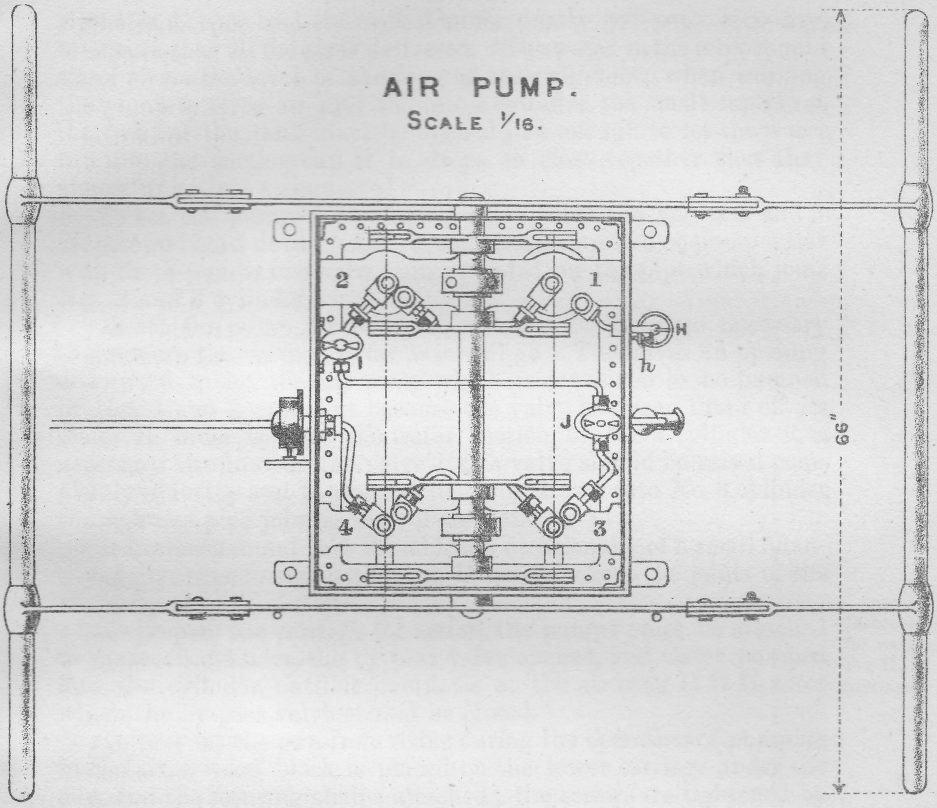
This consists of four cylinders, Nos. 1, 2, 3, and 4, of different diameters, each fitted with a plunger and placed vertically in a tank of water, this serves to keep them cool, and supplies the small quantity of water required to be drawn in, in order to ensure that no air is left undelivered at the end of each stroke, it also protects the valve and gland joints by keeping them moist. The cylinders are arranged as shown on drawing, No. 1 being the largest in diameter and No. 4 the smallest. When in action the plungers of Nos. 1 and 3 are withdrawn while the plungers of Nos. 2 and 4 are being forced into their respective cylinders, and *vice versâ*. No. 1 cylinder alone draws in a charge of air at a pressure of one atmosphere (14·7 lb. per square inch). A small quantity of water is also drawn in by this cylinder and when its plunger rises it delivers its charge of air to No. 2 cylinder in which the plunger is falling. No. 1 cylinder having delivered all the air, will, at the extreme end of the stroke, deliver the small quantity of water which was also drawn in. This will ensure that there is no air left to expand and reduce the suction for the next stroke. In the same way No. 2 cylinder delivers its charge on the return stroke to No. 3 cylinder and the process of compression is carried a stage further. Then No. 3 cylinder, delivers its charge to No. 4 cylinder, and No. 4 completes the compression up to the highest pressure required in the recoil cylinder.

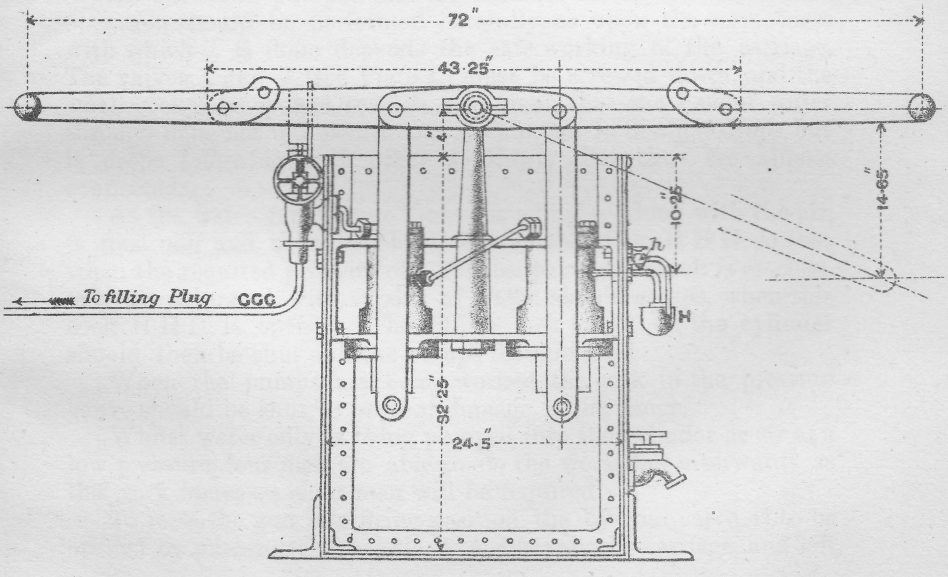
The handles of the pump are made to take four men on each side, and when not in use they may be folded back so as to occupy less space.

In using the pumps it is of great importance to make the full

# AIR PUMP.

SCALE 1/16.




DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12453

stroke each time and strike the buffer gently, yet with certainty, to ensure that all the air is delivered. The water in the tank should stand above the level of the tops of the cylinders; when working the pump to force air into the recoil cylinder, the small tap (*h*) at the front of the tank must be opened just enough to let the water run into the suction cup H in drops so close together that they almost unite into a connected stream.

To set the pumps for pumping air, see that the valves I and J are screwed hard down. As it is sometimes required to pump water with these pumps two valves are provided on the pipe which joins Nos. 2 and 3 cylinders.

To set the pump for pumping water, it is therefore necessary to screw up the valve I as far as it will go. This gives an opening downward to let the air away which is continued to be pumped by Nos. 1 and 2 cylinders because the valve has been lifted off its seat. In order to give the water suction to No. 3 cylinder it is necessary also to open the valve J, this valve should be raised completely to its top seat to prevent air being drawn into No. 3 cylinder through the pipe joining the valves I and J.

It has been found that the addition occasionally of a small quantity of glycerine in the suction cup H helps to keep the joints of the air pump tight.

Instructions for working the H. P. carriage.

To prepare the carriage for action, the pumps must be attached to the recoil cylinder, the by-pass valve opened, and water pumped into the cylinder, until it overflows at the air cock H H H, after which the by-pass valve should be closed.

To prevent the gun from rising during the operation of pumping in the air, a wood block is placed on the lower carriage under the gun, and the securing chains attached; the screws are tightened by means of a "tommy" key, supplied for the purpose.

Air should be pumped into the chamber of the cylinder. This operation should be performed carefully, as upon the correctness with which it is done depends the safe working of the carriage, The valves I and J (see Plate L) must be screwed down, and the small cock *h* be opened to such an extent, that the flow of water through it be not in a continuous stream, nor in distinct drops, but in drops following each other so slowly that they are almost connected.

As the water gets pumped into the cylinder along with the air, it must now and then be blown out at the cock H H H, so that when the required pressure of 1,350 lbs. per square inch is reached, only air saturated with vapour of water should escape, when this cock H H H is opened. The filling cock G G G on the cylinder should then be shut and the pumps disconnected.

When the pumps are being worked the cock in the pressure gauge should be shut, to prevent damage to the gauge.

Whilst water only is being pumped into the cylinder or air at a low pressure, four men are able to do the work, but afterwards as the work increases eight men will be required.

To raise the gun into firing position, the by-pass valve is to be opened by pushing the handle ∆ A, towards the carriage, and left

open until the check chains P are tight when the cut-off gear will close the valve. When the gun is raised for firing, its exact position is determined by the check chains as before intimated. In case the cut-off gear does not act perfectly, the handle $\Delta$ A closing the valve should always be pulled from the carriage before firing.

The gun must never be raised into firing position until the moment before firing.

If the gun has been raised into the firing position, and it is desired to lower it into the loading position, water must be pumped from the chamber *a* into the air chamber *b*, by working the handle of the lowering pump until the gun descends gently on to the buffers N.

When it is desired to insert a new cup leather in the gland of the recoil cylinder, the most speedy method is to disconnect the ram J from the crosshead K, by driving out the cotter, then raise the overbank carriage by means of handspikes, and chock it up to a convenient height. The cylinder will then swing back towards a vertical position (care must be taken to let it swing back gently) and the gland can be removed, and a new cup leather inserted.

The recoil valves are set to suit the highest or battering charge, and when using service charges, the gun is lowered into the loading position by means of the small lowering pump Y Y Y.

Preservation of carriage and fittings.

In order to preserve the carriage in working condition the axle spindles, shafts, pinions, and all bearings should be kept clear of clotted oil and rust, and be well lubricated. When not required for immediate use, the elevating arc and rods, &c. should be coated with a mixture of white lead and tallow. The exposed portions of the ram should be covered with a mixture of white lead and tallow to prevent them from rusting. Before firing, the cylinders should be examined, and the rams and all working parts should be cleaned and oiled.

Weights.

| | Tons. | cwts. | qrs. | lbs. |
|---|---|---|---|---|
| Carriage .. .. .. .. .. .. | 6 | 4 | 1 | 24 |
| Shield complete .. .. .. .. .. | 7 | 3 | 1 | 13 |
| Cylinder and ram .. .. .. .. .. | 1 | 3 | 3 | 21 |
| Pivot bracket, pin, and bolts .. .. .. | 1 | 1 | 1 | 19 |
| Racers, steel, with plates and bolts .. .. | 0 | 14 | 3 | 25 |
| Clip racers .. .. .. .. .. .. | 1 | 10 | 2 | 20 |
| Force pump and gauge .. .. .. .. | 0 | 8 | 3 | 2 |
| Sighting ladders .. .. .. .. .. | 0 | 4 | 0 | 16 |
| Total .. .. .. .. | 18 | 11 | 3 | 0 |

List of parts.

| | |
|---|---|
| A | Elevator, right and left. |
| B | Upper transom of elevator. |
| C | Lower „ „ |
| D | Capsquare of trunnion. |
| E | Gun elevating hoop. |
| F | „ „ bracket (right and left). |
| G | Elevating rod. |
| H | Recoil cylinder with air chamber. |
| I | Brass packing gland (3 parts). |
| J | Recoil ram. |
| K | Cross head of recoil ram. |
| M | Recoil cylinder cover. |
| N | Buffer. |
| P | Check chains. |
| Q | Elevator bracket (right and left). |

| | |
|---|---|
| R | Pin for elevator bracket. |
| S | Truck. |
| T | ,, spur wheel. |
| U | Training pinion. |
| V | ,, shaft. |
| W | Training handwheel. |
| X | Racer. |
| Y | Clip racer. |
| Z | ,, bracket. |
| AA | Girder (right and left). |
| BB | Rear transom. |
| CC | Front ,, |
| DD | Pivot beam. |
| EE | ,, pin. |
| FF | Securing cotter for pivot pin. |
| GG | Pivot block. |
| HH | Clip racer anchor bolts. |
| II | Pivot block ,, ,, |
| JJ | Anchor plates. |
| KK | Shield, pillar, bracket, inner, upper and lower, right and left. |
| LL | ,, ,, ,, front. |
| MM | ,, ,, ,, rear. |
| NN | Toothed elevating arc (right and left). |
| OO | Guide for ,, ,, ,, |
| PP | Pinion for ,, (outer and inner). |
| QQ | Elevating spur wheel. |
| RR | Pinion for elevating spur wheel. |
| SS | Elevating hand wheel. |
| WW | Elevating spur wheel friction cone. |
| XX | Spring for ,, ,, ,, |
| YY | Adjusting nuts for spring for friction cone of elevating spur wheel. |
| ZZ | Elevating gear non-return brake. |
| AAA | Strap for ,, ,, ,, |
| BBB | Pawl for ,, ,, ,, |
| CCC | Cone for ,, ,, ,, |
| DDD | Spring for ,, ,, ,, |
| EEE | Adjusting nuts for ,, ,, |
| GGG | Recoil cylinder filling cock. |
| HHH | Recoil cylinder water level cock. |
| III | Suction connection to lowering pump. |
| JJJ | Recoil valve No. 1. |
| KKK | ,, ,, No. 2. |
| OOO | By-pass valve spindle. |
| PPP | ,, ,, working rod. |
| QQQ | ,, ,, ,, lever. |
| RRR | Gland for by-pass valve. |
| SSS | Securing plate for gland for by-pass valve. |
| TTT | Cotter for recoil ram and cross head. |
| UUU | Bracket for elevating handwheel spindle. |
| VVV | Elevating handwheel spindle. |
| WWW | Elevating shaft. |
| XXX | Inlet for lowering pump. |
| YYY | Lowering pump with guard. |
| ZZZ | Guide plates for check chains. |
| Δ | Sighting ladder and platform. |
| ΔA | Handle for working by-pass valve. |
| ΔB | Securing chain for ,, ,, |
| ΔE | Reflecting sights upper and lower. |
| ΔF | Tie rods for front pillars. |
| ΔG | ,, ,, for rear ,, |
| ΔH | Shield pillars front and rear. |
| ΔJ | Shield. |

## CHAPTER XII.—PIVOTS AND RACERS FOR TRAVERSING PLATFORMS.

The pivot or fixed point, about which, as a centre, the platform traverses, is varied according to the nature of the battery, in which it is mounted. The different positions of the pivots are distinguished by the letters A, B, C, D, E, F. The A pivot is about under the muzzle of the gun when run up; B just in front of the breast of the platform; C about the centre of the platform; D about 3 ft. in rear of C; E in front of the rear transom; and F in rear of it.

The pivot may be "actual" or "imaginary." An actual pivot is formed by a cast-iron gun or pivot block sunk in the ground in the required position, to which the platform is connected by a steel plug. When the pivot is imaginary the platform is not connected to any fixed point. Platforms for rifled guns are in general connected to actual pivots, except those intended for A pivots which are generally imaginary.

§ 4647. The pivot blocks in the service have been for purposes of nomenclature placed in a numbered series, as also have the pivot plugs.

The following are the blocks:—

| No. of Block. | Total height. | Height above racer. | Natures of platforms for which intended. | Pivot plugs, for which suitable. |
|---|---|---|---|---|
| | ft. in. | ft. in. | | |
| No. 1 | 4 9·62 | 0 15·5 | R.M.L., 10″ C .. .. | No. 1 |
| „ 2 | 4 4·75 | 1 10·75 | R.M.L., 9″ and 7″ C and D .. | „ 1 |
| „ 3 | 3 4·87 | 1 6·375 | R.M.L., 7″, 6½ tons, 6′ parapet; 64-pr. 64 cwt., 5′ 6″ and 6′ parapets .. .. .. | „ 3 |
| „ *3I | 3 4·87 | 1 6·375 | R.M.L. 80-pr. 5 tons, 64-pr. 71 and 58 cwt., 6′ parapet .. | „ 4 |
| „ *3II | 3 6·2 | — | R.B.L., 7″, 82 cwt., R.M.L. 64-pr. 71 and 58 cwt. .. | „ 12 |
| „ 4 | 2 10·75 | 1 0·52 | R.B.L., 7″, 82 and 72 cwt.; R.M.L., 80-pr. 5 ton, 64-pr. 71 cwt. .. .. .. | „ 4 |
| „ 5 | 3 8·75 | 1 2 | R.M.L., 7″, 6½ ton (slide converted for L.S.) .. .. | „ 5 |
| „ 6 | 2 11 | 1 9 | R.M.L., 9″ Moncrieff, Mark II | „ 6 |
| „ 7 | 1 11·5 | 0 9·5 | R.M.L., 7″ Moncrieff, Mark II | „ 7 |
| „ 8 | 2 0 | 0 9 | R.B.L., 7″ 82 cwt., R.M.L., 64-pr. 58 cwt., Moncrieff, Mark II .. .. .. | „ 8 |
| „ 9 | 3 4·87 | 0 4 | R.M.L., 8″ howitzer, 70 cwt. carriage .. .. .. | 13 and 14 |
| „ 10 | 4 1·5 | 1 2 | R.M.L., 8″ slide (converted for L.S.) .. .. .. | No. 15 |
| Fixed plug. | — | — | R.M.L., 7″ Moncreiff, Mark I | Fixed plug. |

* Bushed.

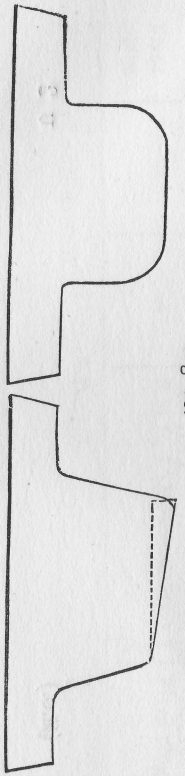
The following are the plugs:— § 4647.

| No. of Plug. | Diameter. | Length in block. | Block or gun for which intended. | Natures of platform for which suitable. | Para. L of C, described. |
|---|---|---|---|---|---|
| | in. | in. | | | |
| No. 1* | 5·82 | 8·5 | 24-pr. gun pivot and blocks Nos. 1 and 2. | R.M.L. 7″ and upwards C and D .. .. | 2411 |
| „ 2* | 5·29 | 7·5 | 18-pr gun pivot | R.M.L. 7″ and upwards C and D .. .. | 2411 |
| „ 3 | 4·00 | 5·75 | No. 3 | R.M.L. 7″ 6½ tons, 64 cwt. 5′ 6″ and 6′ parapet | |
| „ 4 | 3·00 | 7·5 | „ †3 and 4 | R.M.L. 80-pr. 5 tons, 64-pr. 71 and 58 cwt. 6′ parapet. R.B.L. 7″, R.M.L. 80-pr. 5 tons, 64-pr. 71 cwt. and 58 cwt. | |
| „ 5 | 3·00 | 13·5 | „ 5 | 7″ 6½ tons slide fitted with special bars for L.S. | |
| „ 6 | 4·00 | 13·5 | „ 6 | R.M.L. 9″ Moncrieff II. | |
| „ 7 | 3·50 | 10·75 | „ 7 | R.M.L. 7″ „ „ | |
| „ 8 | 2·50 | 9·5 | „ 8 | R.B.L. 7″ R.M.L. 64-pr. 58 cwt. Moncrieff II | |
| „ 9* | 4·198 | 7·5 | 9-pr. gun pivot | R.M.L. 7″ and upwards C and D .. .. | 2411 |
| „ 10 | 2·50 | 5·0 | — | R.B.L. 40-pr. | |
| „ 11 | 2·00 | 7·5 | — | S.B., B.L. 32-pr. .. | 4093 |
| „ 12 | 3·00 | 7·5 | No. ‡3 | R.B.L. 7″ 82 cwt. R.M.L. 64-pr. 71 and 58 cwt. | |
| „ 13 | 5·00 | 15·0 | „ 9 | R.M.L. howitzer carriage, 8″ 70 cwt. | |
| „ 14 | 5·00 | 15·0 | „ 9 | R.M.L. howitzer carriage, 8″ 70 cwt. | |
| „ 15 | 4·00 | 13·5 | „ 10 | R. M. L. 8″ converted slide L.S. | |

* Plugs Nos. 1, 2, and 9, are interchangeable, as far as the platforms are concerned, the body of No 1 plug and the head of No. 2 or No. 9 fitting the pivot holes in the pivot plate and cross stay of the platform. For C platforms, R.M.L. 11 inch or 12 inch 25 ton, the pivot plug is secured by a clip plate, Fig. 70 page 239.

† Bushed I. ‡ Bushed II.

The following table gives the position of the different pivots, with respect to the front of the platform, with which they are used: and also the plug and block used with each platform:—



RACERS.
Fig. 88.

| Nature of Platform. | Radius of Racers. | | | | | | | | | | | | No. of Pivot Block. | No. of Pivot Plug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Front. | | | | | | Rear. | | | | | | | |
| | A | B | C | D | E | F | A | B | C | D | E | F | | |
| | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | ft. in. | | |
| 12″ B.L. ... {Upper Tier | 9 2 | — | — | — | — | — | 18 0 | — | — | — | — | — | — | — |
| 12″ B.L. ... {Lower Tier | 9 2 | — | — | — | — | — | 21 2 | — | — | — | — | — | — | — |
| 12·5″ 6′ recoil R.M.L. ... | 10 2 | — | 5 8 | 8 0 | — | — | 20 2 | — | 5 8 | 3 8 | — | — | 24-pr. gun | No. 1 Plug |
| 12·5″ 7′ recoil R.M.L. ... | 10 2 | — | — | — | — | — | 21 2 | — | — | — | — | — | — | — |
| 12·5″ S.P. 6′ recoil R.M.L. | 10 2 | — | — | — | — | — | 20 2 | — | — | — | — | — | — | — |
| 12·5″ S.P. 7′ recoil R.M.L. | 10 2 | — | — | — | — | — | 21 2 | — | — | — | — | — | — | — |
| 12″ R.M.L. 35 tons ... | — | — | 5 8 | — | — | — | — | — | 5 8 | — | — | — | 24-pr. gun | No. 1 ,, |
| 11″ or 12″ R.M.L. 25 tons | 8 0 | — | 5 8 | 9 0 | — | — | 18 0 | — | 5 8 | 3 0 | — | — | 24-pr. gun | No. 1 ,, |
| 10″ ,, 18 ,, | 8 0 | — | 5 8 | 9 0 | — | — | 18 0 | — | 5 8 | 3 0 | — | — | No. 1 block | No. 1 ,, |
| 9″ ,, 12 ,, | 6 3 | — | 5 5¾ | 9 0 | — | — | 16 6 | — | 5 5¾ | 2 3¾ | — | — | No. 2 ,, | No. 1 ,, |
| 7″ ,, 7 ,, | 6 3 | — | 5 5¾ | 9 0 | — | — | 16 6 | — | 5 5¾ | 2 3¾ | — | — | No. 2 ,, | No. 1 ,, |
| No. 1 Medium ... ... | 5 0 | — | — | — | — | — | 14 0 | — | — | — | — | — | — | — |
| ,, 2 ,, ... ... | 5 0 | — | — | — | — | — | 14 0 | — | — | — | — | — | — | — |
| ,, 3 ,, ... ... | 5 0 | — | — | — | — | — | 14 0 | — | — | — | — | — | — | — |
| ,, 4 ,, ... ... | — | 1 7½ | — | — | — | — | — | 8 7½ | — | — | — | — | — | No. 10 ,, |
| ,, 5 ,, ... ... | — | 1 5 | — | — | — | — | — | 6 10 | — | — | — | — | — | — |
| ,, 6 ,, ... ... | — | 1 6 | — | — | — | — | — | 6 10 | — | — | — | — | — | No. 11 ,, |
| ,, 7 ,, ... ... | — | — | 6 1 | — | 10 8¼ | 12 10 | — | — | 6 1 | — | 2 2 | 2 2 | No. 3 ,, | No. 3 ,, |
| ,, 8 ,, ... ... | 5 0 | — | 6 1 | — | 10 8¼ | 12 10 | 16 6 | — | 6 1 | — | 2 2 | 2 2 | No. 3 ,, | No. 3 ,, |
| ,, 9 ,, ... ... | — | — | 6 1 | 9 0 | — | — | — | — | 6 1 | 3 4¼ | — | — | No. 3 ,, | No. 3 ,, |
| ,, 10 ,, ... ... | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| ,, 11 ,, ... ... | 5 0 | 1 10 | 6 1 | 9 3 | 10 8¼ | 12 10 | 16 6 | 12 10 | 6 1 | 3 4¼ | 2 2 | 2 2 | No. 3* ,, | No. 12 ,, |
| ,, 12 ,, ... ... | 5 0 | — | — | — | — | — | 16 6 | — | — | — | — | — | — | — |
| ,, 13 ,, ... ... | 5 0 | — | — | — | — | — | 16 6 | — | — | — | — | — | — | — |
| ,, 14 ,, ... ... | 5 0 | — | — | — | — | — | 16 6 | — | — | — | — | — | — | — |
| ,, 15† ,, ... ... | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| ,, 16 ,, ... ... | — | — | 6 1 | 9 3 | 10 8¼ | 12 10 | — | — | 6 1 | 3 4¼ | 2 2 | 2 2 | No. 4 ,, | No. 4 ,, |
| ,, 17 ,, ... ... | 5 0 | 1 10 | — | — | — | — | 16 6 | 12 10 | — | — | — | — | — | — |
| ,, 18 ,, ... ... | — | — | 6 1 | 9 3 | 10 8¼ | 12 10 | — | — | 6 1 | 3 4¼ | 2 2 | 2 2 | No. 3‡ ,, | No. 4 ,, |
| ,, 19 ,, ... ... | 5 0 | — | — | — | — | — | 16 6 | — | — | — | — | — | — | — |

* Bushed II. † Converted naval slide. ‡ Bushed I.

Racers.

The racers for medium platforms on which rifled guns are mounted are of wrought iron 2·25″ deep, 2·78″ wide, Fig. 88, with the upper surface rounded off and with a flange ·75″ deep at each side. They are laid raised, *i.e.*, with the upper surface standing above the ground.

The exceptions to the above are the racers for Nos. 4 and 5 platforms, which are of gunmetal, ribbed and coned to suit the pivot.

Wooden platforms for S.B. guns may be mounted on racers either with or without flanges.

Racers for R.M.L. 7″ and 9″ traversing platforms, Fig. 88, are of similar form to those for medium guns.

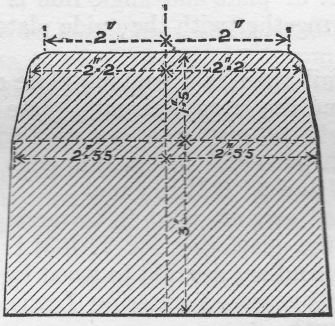
§ 2458.

The steel racers for 10″ R.M.L. guns and upwards to 12″ of 25 tons, Fig. 88, have straight sloping sides with a flange at the bottom while the upper surface is beveled to suit the cone of the trucks for the particular pivot, except in the case of the rear racers for "A" pivot, which are not beveled on account of those for two adjacent guns in some works crossing each other. The dimensions of the flange are the same as in the wrought-iron racer. The height to the axis of the cone or bevel is $2\frac{1}{4}$″; the latter is 2·44″ long, and the width at the bottom just above the flange 3·48″. The flanges of the trucks are allowed $\frac{1}{10}$″ play between them and each side of the racer, and $\frac{1}{4}$″ between them and the flange of the racer. Continuous bedding plates of wrought-iron are now used in laying racers for 10″ guns and upwards to 12″ of 25 tons, instead of bedding plates under the ends of the different pieces of the racer; they are made to break joint with the pieces of the racer, the latter being secured to them by steel bolts with wrought-iron nuts, L. of C., § 2906.

Steel racers, Fig. 88A, of deep section, without flanges, connected

§ 2980.

Fig. 88A.




at the joints by 2″ steel dowels, and laid without bedding plates, are made for 35 and 38 ton guns. For A pivot the front racer is in one piece, and in confined works, where the rear racers intersect, crossing plates of cast steel are used.

To prevent the platform running off the racers, a stop is fixed at each end. The stop for all flanged racers is a $\frac{5}{8}$″ screw, with a projecting head 1″ in diameter and 1″ in height, which is screwed into the flange. The stop for 35 and 38 ton racers is a piece of

wrought iron bedded into the masonry to the depth of the racer, and projecting $1\frac{1}{8}''$ above the bottom of the sinking for the flange of the truck.

**Recoil rails.** Recoil rails are fixed to the floor and roof of casemates intended for the yoke mounting of the B.L. 12″ 43 ton gun.

The lower rail of the lower tier platform consists of a guide plate of steel, $1\frac{1}{4}'' \times 9\frac{1}{2}''$ along the surface of which the lower roller of the yoke runs in traversing, and against which it bears during recoil. At the rear of the guide plate are riveted two angle irons; between these is riveted a horizontal 2″ plate of steel. The rear part of this plate acts as a racer for the front trucks of the platform; the plate abuts in front against the rear of the guide plate, and in rear against the front racer of the R.M.L. 38 ton gun, for which the casemate was fitted.

The 2″ racer plate is formed in two lengths, united at the centre by the angle irons and by a 1″ joint cover of wrought iron riveted underneath.

The guide plate is sunk $5\frac{1}{2}''$ into the floor of the work, which is lowered 5″ in front of it, so as to form a trough 1′ 1″ wide. A $1\frac{1}{2}''$ plate of wrought-iron is fixed at the front side of the trough.

The upper rail consists of a front and rear guide plate for the upper rollers of the yoke, the front of wrought iron, the rear of steel, both $1'' \times 7\frac{3}{4}''$. These plates are connected by angle irons to a horizontal plate ($1'' \times 5'\ 0\frac{7}{8}''$ at the centre), which is fixed to the roof of the casemate.

The front guide plate and its angle iron are moveable, the angle iron being connected with the horizontal plate by bolts instead of rivets, so as to admit of the yoke being got into position.

The rails for the upper tier platform are generally similar. In the lower rail the racer plate does not abut against the old racer in rear. A box girder of plate and angle iron is built up under this plate, and is sunk together with the guide plate to a depth of 7″ in the floor.

In the upper rail there is a packing plate of $1\frac{1}{2}''$ iron between the guide plates and the large horizontal plate fixed to the roof.

**Traversing racks.** Traversing racks of cast iron are used with platforms for 35 and 38 tons R.M.L. guns and 43 ton B.L. guns, also with converted naval slides for 8″ and 9″ R.M.L. guns.

**Graduated arcs.** Fixed graduated arcs are used in traversing in connection with the pointers on the platforms, for 9″ R.M.L. guns and upwards. They are of metal, and are secured to wood by wood screws, and to stone or concrete by screws entering Lewis nuts, the end nuts being of double depth.

They are graduated in degrees with quarter intervals.

These arcs have for purpose of nomenclature been placed in a numbered series.*

**Sweep plates.** Moncrieff platforms are traversed on sweep plates with stops as for flanged racers, and a graduated arc of zinc let into the rear plate.

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* These arcs will for future manufacture be made in two separate parts. The graduations will be marked on the front part, and on the rear part or figure plate which will be issued in short lengths of 10°, the numbers corresponding to the graduations will be shown.

The following are the radii of the traversing racks and graduated arcs respectively.

| Nature of Platform. | Traversing Racks. | | | | | | Graduated Arcs. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | C | | D | | A | | C | | D | |
| | ft. | ins. | ft | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. |
| B.L. 12″ lower tier ... ... ... | 14 | 5 | — | | — | | 19 | 4·25 | — | | — | |
| ,, ,, upper ,, ... ... ... | 14 | 5 | — | | — | | — | | — | | — | |
| R.M.L. 12·5″ 6 ft. recoil ... ... | 14 | 5 | 3 | 4·47 | 5 | 6 | 19 | 4·25 | 4 | 9·75 | 4 | 9·75 |
| ,, ,, 7 ft. ,, ... ... | 15 | 5 | — | | — | | 19 | 4·25 | — | | — | |
| ,, ,, 6 ft. ,, S.P. ... | 14 | 5 | — | | — | | 19 | 4·25 | — | | — | |
| ,, ,, 7 ft. ,, S.P. ... | 15 | 5 | — | | — | | 19 | 4·25 | — | | — | |
| ,, 12″ 35 tons ... ... ... | — | | 3 | 4·47 | — | | — | | 4 | 9·75 | — | |
| ,, 10″ and 11″ or 12″ 25 tons | — | | — | | — | | 21 | 4·75 | 4 | 9·75 | 3 | 8·75 |
| ,, 9″ ... ... ... ... | — | | — | | — | | 20 | 0 | 4 | 9·75 | 3 | 0·75 |
| ,, 9″ converted slide ... ... | 11 | 5·5 | — | | — | | — | | — | | — | |
| ,, 8″ ,, ,, ... ... | 11 | 5·5 | — | | — | | — | | — | | — | |

## CHAPTER XIII.—INSTRUCTIONS FOR THE CARE AND PRESERVATION OF IRON CARRIAGES AND PLATFORMS.

Iron carriages and platforms of every description require special care to preserve them from the effects of the weather, and to keep them in working order, otherwise they will be deteriorated by rust, and the working parts become so corroded as to induce irregularity in action and difficulty in working.

The following instructions apply generally to all mountings:—

1. When mountings are not frequently used, the moveable parts of the elevating gear, the adjusting screw shaft, compressor, nuts and rocking levers of the compressor gear, and the blocks and tackle of the running-back gear, must be removed and placed in store.

These parts must be kept clean, and placed in position at least once in three months, to see that they are in proper working order. All other gear should be worked once a week to ensure it being in a clean and working condition.

2. The top of the platform must be rubbed with an oily rag to keep it from rusting and to keep the under surface of the carriage in good condition, the carriage must be raised on its rear rollers, oil poured underneath as far as possible, then lowered and worked in and out sufficiently to oil the whole surface. Before practice all traces of oil should be removed from the bearing surfaces of carriage and platform to prevent excessive recoil.

3. The teeth of traversing gear should be greased. The position of the platform must be changed to prevent impressions on the trucks and racers. The racers should be scraped and cleaned, especially at the sides to render traversing easy.

4. All bearings should be lubricated at least once a month, and *always before practice*. During practice the top of the platform should be occasionally rubbed with a slightly oily cloth to prevent seizure. With regard to this paragraph and the directions in

paragraph 2, it should be clearly understood that paragraph 2 refers to the precautions required in the ordinary course of preservation, and paragraph 4 to practice. A liberal use of oil is necessary to ensure the removal of rust, and great care is required to remove all superfluous traces of it before firing. A slight film of oil is to be renewed during practice to prevent seizure. Carriages with rollers permanently in action should have the rollers, and axles kept clean and thoroughly lubricated. In lubricating, the lubricating holes must be cleaned out with a wire (if necessary) and filled with oil, care being taken to replace the small screws. Bearings are not thoroughly lubricated unless the oil shows on the shafting.

5. All working parts must be kept free from dirt and rust. The clamping arrangement or friction cones of elevating gear, brake drums and the discs of friction clutches, must be cleaned but *not oiled*. The plates and bars of the compressor and preventor gears must on no account be greased but should be kept free from rust by scraping to ensure regularity in working. The teeth of traversing and brake gear wheels, must be greased occasionally to ensure easy working and preserve them from rust.

6. Rollers and trucks, where practicable, must be removed once a month, and the axles properly cleaned and greased before replacing.

The operation of removing and cleaning rollers and axles should be carried out where ordnance artificers are available at least once a month. In the case of other pressing work occupying their attention the period may occasionally be extended to once in four months but not longer.

Where there are no ordnance artificers the lubricating holes must be thoroughly cleaned out, and as much fresh oil as possible poured into the bearing, the rollers being turned round during the operation. The turning of the rollers will be facilitated by first raising and blocking up the carriage.

NOTE.—The front trucks are removed by running the carriage back and lifting the front of the platform by hydraulic jacks sufficiently high to take the weight off the trucks. Great care must be taken to block up the platform before removing the axles. For the rear trucks, run the carriage up, place the jacks under the rear truck plate, and proceed as for the front trucks.

7. Hydraulic buffers should be carefully examined before firing, to see that the cylinders contain the requisite quantity of fluid, that there is no leakage at the glands, and that the piston rods are properly connected; also see that the clip plates are securely bolted to the carriage. If a buffer leaks at the gland, and tightening up the latter does not stop it, the packing must be renewed.

### SPECIAL INSTRUCTIONS FOR 38 TON MOUNTINGS.

The carriage must never be fired from until it is seen that the buffer piston rod is attached to the platform; that the hydraulic buffer is filled with the proper quantity of oil; that the clip plates are on and secured; that the preventor gear lever is allowed to relax the grip on the bar; and that the nipping lever of the

running-back gear is well pressed down and caught by its pawl to ensure the sprocket plates being free of the chains.

Hydraulic buffer.

*To fill the Buffer.*—Run the carriage up to the front stops, with the piston rod secured to the front of the platform; take out the screw plug on the top of the buffer at the rear, and rest the gallon measure in the hole, turn off the cock, and fill the measure *full;* then turn the cock and allow the oil to flow into the cylinder, repeat the operation until the buffer is full then draw off a measure full, equal to one quart. Replace the plug, screwing it home.

The working quantity of oil used should not exceed { 6′ recoil, 10 gallons. 7′ „ 11¼ „

Oil is withdrawn by means of the front screw valve, air being let into the cylinder at the same time by the removal of the rear plug.

A "spanner, hydraulic buffer, No. 21," with a tommy, is issued for loosening or tightening the packing gland of the tension buffer, and a "spanner, hydraulic buffer, No. 6," for removing the rear plug and for opening or closing the draw-off valve in the front buffer cap. A "spanner, McMahon," is used for screwing and unscrewing the bolts and screws.

*To connect the Buffer Piston-rod to the Platform.*—Move the carriage to the rear, if not already in that position, sufficiently to enable a man to get at the piston rod, remove the connecting nut from it, and draw it forward until its end projects through the hole in the transom of the platform, taking care not to injure the thread, screw on the connecting nut, and secure it from turning by driving in the taper steel pin; the inside nut should be adjusted so as to allow of a free vertical movement of the rod. Before connecting to the platform, the rod should be pushed in and out to see that it works freely and that the packing gland is not too tight.

*N.B.*—In all operations, such as connecting and disconnecting the piston rod of a buffer, care should be taken that the carriage is securely scotched up on the platform, to prevent its running up suddenly. Under no circumstances should the carriage be run up by placing it on its rear rollers, unless the piston-rod is secured to the platform.

If the buffer leaks at the gland, and the leakage cannot be stopped by tightening the latter, the packing must be renewed. Materials for packing are detailed in the following table:—

| | | | First supply for each buffer. | Annual supply for five buffers. |
|---|---|---|---|---|
| For tension buffers. | Lead | red, dry .. .. .. ozs. | 4 | 8 |
| | | white, ground in oil .. „ | 4 | 8 |
| | Leathers | cap .. .. .. No. | 1 | 5 |
| | | piston rod .. .. „ | 1 | 5 |
| | Oil, linseed, boiled .. .. .. pint | | 0⅛ | 0¼ |
| | Rope, cotton, white .. .. .. ozs. | | 4½ | 9 |
| | Tallow .. .. .. .. „ | | 1½ | 3 |

If the cap has at any time to be removed, in replacing it, red or white lead should be used to make a close joint.

To remove the piston it will be generally found necessary to take the buffer off the carriage, and remove the front cap, first taking out the set screw. If found to be practicable it is more desirable to take off the rear cap but the cement which makes the joint tight, will generally prevent this. In the steel buffers recently issued the joint of the rear cap is made tight by a gutta-percha ring; in these buffers the rear cap should be removed to get at the piston.

* Rear roller jack.

The hydraulic jack should be worked frequently (after the carriage has been securely scotched up under the front rollers to prevent the gun running up) as the leathers of the jack become hard and get out of order if not in constant use. The spare jacks in store should also be worked, and invariably be left with pressure on.

*To fill the Jack.*—Remove the cover by taking out the four screws and fill the jack with the authorised fluid. The mixture must be filtered into the jack through the "filter, tin, jack, lifting," page 340.

The present authorised fluid for filling the jack is a mixture of water and methylated spirit, in the proportion of two of the former to one of the latter, to which has been added 1 oz. of common soda to the gallon.

A mixture of 2 parts paraffin oil and 1 part olive oil may supersede this fluid. The jack must be cleaned out every three months, and the mixture passed through the filter when returning it to the reservoir.

Capacity of the jack—4 quarts.

Should the rear roller jack not act, it should be rapidly worked, at the same time the outside of the cistern should be tapped with a piece of wood, to dislodge any dirt that may have got into the pump. If this has no effect, it should be removed and replaced by one from store. The jack when out of order should be cleaned out as directed above, if it still remains out of order, it must be carefully taken to pieces, examined, and adjusted by a competent person.

If the jack should break down in *action*, the gun, in cases of emergency, can be run up by using the nipping and running-back gear, the indicator being adjusted for running back, and the winch handles worked in the reverse direction.

Care should be taken not to pump the rear roller jack too high, about $\frac{3}{4}''$ should be sufficient as a general rule, and the pointer should be arranged for this height.

Where preventor gear is not fitted in running up, care should be taken to lower the jack as soon as the carriage starts, to prevent the carriage running against the front stops with violence.

**Preventor gear.**

Should it be found that the gun is running up too quickly, the preventor gear must be set up by hand by raising the lever on the outside of the right bracket. If this gear is in proper adjustment the carriage should be brought to rest as it comes in contact with

* For further instructions as to care of this jack see Appendix H.

the front buffer stops. Should the gear require adjusting, remove the retaining nut and pin and change the position of the lever on the screw as required; the higher the number on the shaft to which the arrow on the lever points the greater the compression. The nut and pin must be replaced before testing the resistance.

In general, the proper amount of check will be obtained if, with the full force of one man on the lever, its tripping end can be raised to about 1″ below the top of the tripper. Immediately the carriage is run up, the grip on the bar must be relaxed by lowering the lever to prevent the movement of the carriage being retarded while running back or during recoil.

**Elevating gear.**

Should the position of the clamp handle of the elevating gear be found inconvenient, when the arc is clamped, it can be adjusted by removing the split key and handle, placing the latter in a new position on the hexagon of the screw, and replacing the key. No oil or grease should be allowed on the friction pieces of the clamp.

**Running back gear.**

Should the running back chains not be in a position suitable for the engagement of the sprocket plates in the nipping gear, move the chains slowly by the winch handles, at the same time pressing the nipping lever on the carriage steadily up, until the teeth catch in the chains.

The clutch, should, after each movement, be disengaged by turning the handwheel until the indicator is at "O" in the centre. The letters T and R merely indicate the direction in which to turn the handwheel. The amount of turning should be only such as will set the clutch and prevent any slip. After the clutch is engaged and movement commences, it may be eased off to lessen the end thrust. Care should be taken that no oil or grease is upon the plates of the disc-clutch, and that if at any time they are removed, when replacing them that they are free from dirt and rust. The clutch lever has a band with trunnion, which is provided with a lubricating hole. Oil should be supplied to this. On no account must this gear be used as a "brake" in running up, as such use will cause serious damage to the gear, and render it unserviceable.

**Front rollers.**

The carriage rollers should revolve freely by hand upon their axles, and only take a bearing on the platform when the eccentric is thrown into gear. This should be done by pumping the rear roller jack until the carriage at the rear rollers is raised $\frac{3}{4}$″. In this position there should be a clear space between the surfaces of the carriage and platform sufficient to see light. Should this not be the case, the front roller bearings will require adjustment.

**Front buffers.**

The faces of the buffer blocks upon the carriage and platform should be parallel one to the other, or else the spindles of the buffers are liable to be bent.

**Traversing gear.**

Traversing gear should be worked once a week to test its condition, and also that the position of the platform on the racers may be changed. The toothed gearing and pinion working in the rack should be kept thoroughly clean, the teeth slightly greased. The discs of the clutch should not be oiled, but the clutch lever band should be.

Before the platform and carriage are used all the lubricating screws should be taken out, and oil poured into the holes and the screws replaced. Some of the screws are under the footboards inside the rear of the platform. By taking out the key of the left buffer spindle, removing the spindle and india-rubber ring the boards can be lifted out and the lubricating screws taken out for oiling. They must then be replaced, as well as the boards and buffer spindle.

*To Remove the Clutch Shaft.*—Take out the pin in collar of indicator screw and run the screw out of the nut; remove the bracket carrying the clutch lever, take off the caps of the bearings of the cross shaft and of the traversing shaft, and in casemate platforms, loosen the bolt in the front bracket of the traversing shaft.

Loosen the bolts of the thrust brackets; lower the cross shaft and remove it, blocking up the shaft to prevent its falling. When out, remove the clutch lever by taking out the screws.

Any difficulty in moving the mountings, or extra exertion required to work the gear, is due either to deficient lubrication or to the connection of some of the gear which is not then in use. In either case the cause should be ascertained without delay, as to continue working under the circumstances may be the means of putting the gun out of action.

SPECIAL FOR SMALL PORT CARRIAGES AND PLATFORMS.

The carriage must never be fired from, until it is seen, that the trunnion blocks rest on the following up screws, so that no weight rests upon the hydraulic lift.

Hydraulic buffers.

*To fill the Buffers* 6′ *Recoil.*—Run the carriage up to the front stops, with the piston rods secured to the buffer brackets, under the carriage; take out the screw plug on the top of the buffer near the rear, and rest the gallon measure in the hole; turn off the cock and fill the measure *full*; then turn the cock and allow the oil to flow into the cylinder, repeat the operation until the required quantity is run in. Repeat the same with the second buffer. The greatest quantity of oil in each buffer should not exceed 9 gallons, which with the carriage run up, will give $3\frac{1}{8}''$ depth of oil at the filling hole. This depth may be easily tested by pressing a slip of wood to the bottom of the cylinder, withdrawing it and measuring the wet portion. Replace the plug, which has a leather washer, screwing it home. Oil is withdrawn by means of the front valve, air being let into the cylinder at the same time by the removal of the rear plug. Each buffer must be filled separately, and great care should be exercised that each contains exactly the same quantity of oil, so that the pressure in each buffer may be the same during recoil.

*To fill the Buffer* 7′ *Recoil.*—Run the carriage not quite up to the front stops, so that the piston may clear the filling hole, with the piston rods secured to the front of the platform; take out both screw plugs in the top of the buffers, insert the "pipe, copper, filling hydraulic buffer," in the filling hole, and resting the gallon measure in the pipe, fill the buffers as full as possible, then run the

carriage gently up and finish filling; run the carriage back until the draw-off valve is clear of the front truck plate, and using the draw-off measure take out 1 quart for each buffer. As the buffers are connected by a copper pipe, the quantity of oil required for both buffers can be run in through one filling hole and the necessary quantity can be drawn from either draw-off valve. Replace the plugs, taking special care to screw them home. The working quantity of oil used in each buffer should not exceed 7½ gallons.

A "spanner, hydraulic buffer, No. 2" is issued for loosening or tightening the packing gland of the buffers of the 6′ recoil platforms, and a "spanner, hydraulic buffer, No. 5," for the same purpose for the 7′ recoil. A "spanner, hydraulic buffer, No. 6," for removing the screw plug, and the draw-off cock in the 6′ buffers, and the screw valve in the 7′ buffers. A "spanner, McMahon's," is used for screwing and unscrewing the bolts and screws.

Hydraulic lift.

The hydraulic lift should be worked daily, to ensure that the leathers on bottom of ram are kept in working order. The plate on top of ram should work freely so as to enable it to get a proper grip of the gun. It should be removed when necessary by the screw underneath being taken out, cleaned, slightly oiled, and replaced, great care being taken, that no oil gets on the ram which should be kept clean by wiping with clean oakum or waste.

*To fill the Lift.*—Remove the screw plug in the cover of the cistern, using the "spanner, release valve, filling plug, &c.," insert the "pipe, filling, hydraulic lift," and using the "filter, tin, jack, lifting," (page 340), in the pipe, fill the cistern with the authorised fluid*, replace the screw plug. Capacity of the cistern 2 gallons.

The cistern is emptied by withdrawing the run-off plug under the cistern using the "spanner, cistern cover, and run-off plug."

The lift must be cleaned out every three months and the fluid passed through the filter when returning it to the cistern.

*To remove the Lift from the Carriage.*—Remove the six keys and the plate from the front transom; remove the bearings of the shafts connecting the pump spindles with the levers outside of the carriage, also the shafts. Draw the lift forward, clear of the carriage until it rests on the plate along the centre of the platform, then by means of the "bracket, iron, lifting," and the "bar, wood lifting," remove the lift from the platform.

*Parts Liable to get out of Order.*—The parts of the lift most liable to get out of order are the leather packings, those round the crank spindle and the draw-off and filling plugs would cause the lift to leak externally, and any disorder in them can easily be detected, while those in the ram and pump would injure the lifting power, and would necessitate the removal of the lift from the carriage, its being taken to pieces and carefully examined.

For any examination of the working parts the lift must be removed from the carriage (see instructions for that purpose).

*To get at the Inlet Valve.*—Remove the run-off plug, remove the

* The present authorised fluid for filling the lift is a mixture of water and methylated spirit in the proportion of 2 of the former to 1 of the latter, to which has been added 1 oz. of common soda to the gallon. A mixture of 2 parts of paraffin oil and 1 part of olive oil has been tried, and a solution of soft soap in distilled water is (1887) under trial.

suction pipe of the inlet valve, through the hole for the run-off plug, using the "spanner, suction valve," when the valve will come away with the suction pipe, and the valve and its seating can be examined.

*To get at the Outlet Valve.*—Remove the cover of the reservoir, by taking out the bolts with the small end of the "spanner, cistern cover, and run-off plug," remove the cover of the outlet valve, using the "spanner, pump cap," when the valve can be removed and examined.

*To get to the Plunger.*—Proceed as "to get at the outlet valve," in removing the cover, when the plunger can be withdrawn, and the leather packing examined. In some plungers the packing consists of a leather collar; should this need renewal, remove the screw collar on the end of the plunger, using studs in the "spanner, release valve, &c.," when the leather collar can be removed and replaced with a new one. In some plungers the packing consists of a long strip of leather; should this need renewal, the old strip must be carefully removed, and replaced with a new one, winding it round until the recess is quite full, and then carefully forcing the end into the recess.

*To get to the Leather Packing in the Cap of the Pump.*—Having removed the cover of the reservoir, remove the cap of the pump, using the "spanner, pump cap."

*To get to the Release Valve.*—Remove the small covering screw in the upper part of the plunger, using the "spanner, release valve" when the valve can be removed and examined.

*To get to the Packing Leather on the end of the Ram.*—Remove the ram from the cylinder, and use the "wrench, steel, removing ram leather," to remove the metal disc securing it in position.

*To get to the Leather Packing Rings round the Pump Spindle.*—Remove the gland at each end, using the "wrench, spindle gland."

NOTE.—The covers of inlet, outlet, and release valves have leather seatings; these must be attended to when the pump is taken to pieces.

Following up gear.

The position of the following up screws should always correspond with the height of the gun, as shown by the indices at the trunnions; this can readily be seen by the index plate and pointer on the left bracket of the carriage.

Great care must be taken before firing to ascertain that the weight of the gun rests on the following up screws, and not on the hydraulic lift.

Elevating gear.

Should the position of the clamping handle be inconvenient when set up, it can be adjusted by means of the screw on the end of the elevating spindle.

Should any play (or back lash) occur in the teeth of the pinions moving the screw of the elevating scale, the friction cone in the pinion must be loosened, the lower pinion pressed against the driving side of the teeth on the wheel into which it is geared, while the upper is pressed against the opposite side of the teeth, in this position the pinion is again secured by setting up the friction cone.

Should the elevating scale not register the slightest movement of the screw to which it is attached, the nut at the back of the scale must be adjusted to press against the opposite sides of the threads of the screw by means of the two adjusting screws.

The elevating gear should always be moved in strict accordance with the instructions given on the plate fixed on the carriage (otherwise in lowering, the gear may be strained), which are as follows:—

"*Elevating or depressing.*—Work the bottom handwheel until the left-hand arrow points to the nearest degree and tens of minutes, continue in the same direction until the vernier gives the remaining minutes."

*Raising the Gun.*—While raising the gun, work the top handwheel until the arrow on the right, points to the required station.

*Lowering the Gun.*—For any station between 14 and 7 set the gun to "point blank." While the gun is being lowered, let the breech descend at the same speed as the trunnion, by turning the bottom handwheel. Work the top handwheel until the right-hand arrow points to the required station. For any station between 7 and 3, set the gun to 3° elevation, and proceed as described above.

For any station between 3 and 0, set the gun to 3° elevation and proceed as above.

Lubrication.

The gun should be elevated and depressed frequently, to prevent the trunnions sticking in the blocks, the loops on top of the blocks being removed when necessary, a few drops of oil poured in, and the loops replaced.

The gun should be run up and back, raised and lowered at least once a week, all lubricating screws removed, the holes cleaned and oiled, and the screws replaced. Dust should not be allowed to accumulate in the casemates or passages, as it blows into the fittings, gear, &c., and in time puts them out of order. Particular care should be taken to prevent dust or bathbrick getting on the screws of the elevating gear, which after cleaning should be left slightly oiled. It is unnecessary to keep metal work bright.

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## CHAPTER XIV.—TRANSPORTING CARRIAGES.

### Transporting Arrangements for Sliding Carriages and Traversing Platforms.

For wood carriages and platforms. (R.C.D. photo-lithograph, 60).

For transporting wood sliding carriages short distances on good roads an axletree is passed through a hole for the purpose in the front block; upon this two wheels are placed, and then the rear of the carriage is limbered up to a limber, the pintail of which passes through an eye plate in the rear block.

The axletree is a 3″ bar of round iron 5¾′ long, weighing 1 cwt. 0 qr. 11 lbs., and fitted with plain washers and keys, with rope ties, as linch-pins.

The wheels are No. 86, 4′ 2″ diameter.

The limber, weight 2 cwts. 1 qr. 17 lbs., consists of an iron axletree, an axletree bed, and block of elm, with a perch and its two stays of ash, housed between them. It is fitted with a pintail (with key) over the bolster, and mounted upon No. 78 special wheels, 2′ 4″ in diameter. The perch is fitted with a cross handle for man draught, and a ring for a drag rope.

The same arrangement serves to transport a platform, the axletree passing through bands for the purpose, and the pintail of the limber entering the bent plate between the sides in rear.

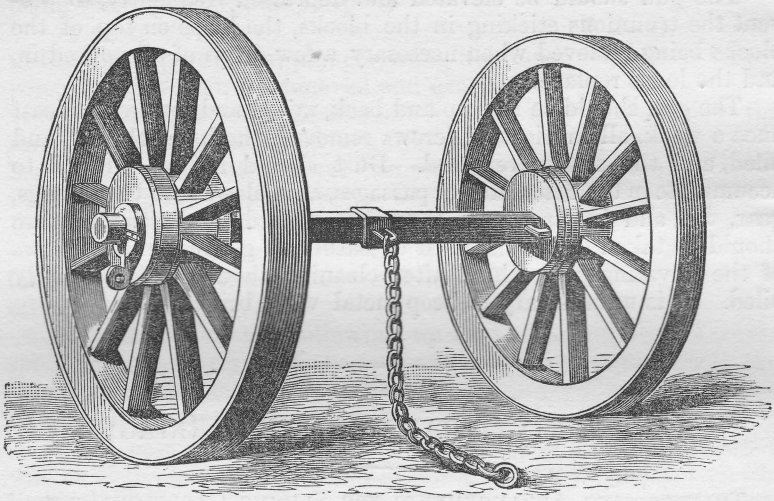
For iron carriages and platforms. (R.C.D. photo-lithograph, 61A.)

Wrought-iron sliding carriages are not fitted for a transporting arrangement, but are transported when necessary upon their platforms. The latter were originally fitted with bands for a square transporting axle, and with an eye for the pintail of the limber; but when they were fitted with gear this arrangement was found impracticable.

L. of C., § 3575.

The axletrees and limber are retained, but the bands and eyes are now ordered to be removed, and the axles are lashed under the platform, which is also supported over the limber by skids lashed underneath.

Fig. 89.



There are four transporting axletrees for iron platforms, of the same section in the body, viz., 4″ square, with cylindrical arms, but differing in length, as follows:—

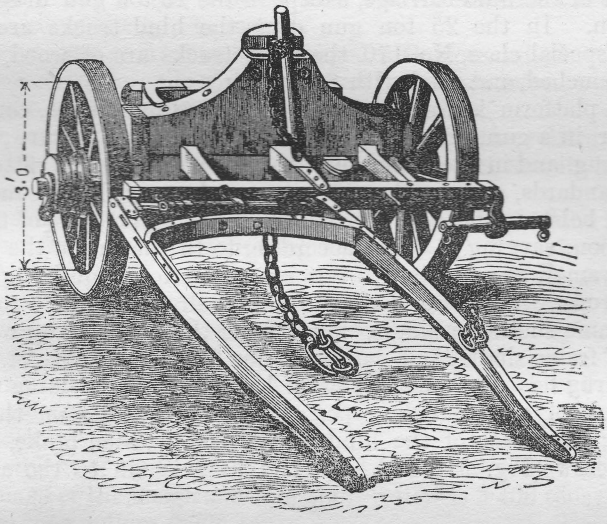
| Nature. | Length. | Weight. |
|---|---|---|
| | ft. in. | cwts. qrs. lbs. |
| 7″ R.M.L. also medium platforms Nos. 1, 2, 3, and 9 | 7 3 | 3 1 4 |
| 9″ R.M.L. .. .. .. .. .. .. | 7 9½ | 3 1 6 |
| 10″ R.M.L. .. .. .. .. .. .. | 8 8 | 3 3 5 |
| 11″ R.M.L .. .. .. .. .. .. | 9 11 | 4 0 8 |

Each axletree is fitted with a pair of drag washers and keys, with rope ties as linch-pins, and a draught chain is attached to it by a socket band. An additional draught chain is required with No. 9 platform.

The wheels are No. 85, 5′ in diameter, having the spokes set without dish. Each is shod with a 6″ ring tire, and weighs 4 cwts. 1 qr. 14 lbs.

The limber, weight 7 cwts. 3 qrs. 0 lbs., consists of an iron axletree, an axletree bed and bolster of elm, with three futchells of ash housed between them. The outer futchells project to the rear, and have a sweep bar attached to them, and all are mortised into a splinter bar of ash in the front. A sweep plate and pintail is fitted upon the bolster, and a keep chain with hook to the centre futchell.

Fig. 90.




The splinter bar has a pair of frame shafts for single or double draught, a swingletree being also supplied for the latter. The wheels are second class A No. 18, 3′ in diameter. A draught chain with a tongue and slip ring is attached to a bar on the rear of the limber for connexion with the chain of the axle.

The 7″ and 9″ axles are sufficiently strong to take the gun without its carriage on the platform, but this method of transporting the gun should only be resorted to on emergency.

## Platform Wagon.

Platform wagon.

The platform wagon is the same as described for siege service, but without fittings for spare stores, and without bale hoops and canvas cover. It will carry about 3½ tons.

The following are the drugs in the service :—

Drugs. (R.C.D., photo-litho-graph, 74 and 74A.)

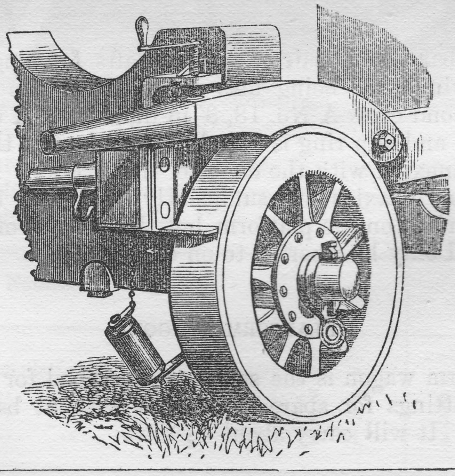
| Nature. | Weight. | | | Tonnage. | Diameter of Trucks. | | Track of Trucks. | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Fore. | Hind. | | |
| | cwts. | qrs. | lbs. | tons. | ins. | ins. | ft. | ins. |
| Small or West India drug .. | 5 | 0 | 0 | ·58 | 18 | 18 | 3 | 2 |
| Medium .. .. .. | 10 | 2 | 0 | 2·02 | 20 | 20 | 3 | 9½ |
| Large .. .. .. .. | 17 | 2 | 0 | 2·17 | 24 | 24 | 3 | 8 |
| Gun drug, 5 tons .. .. | 16 | 1 | 0 | 1·81 | 24 | 24 | 3 | 8 |
| ,, 25 tons .. .. | 61 | 1 | 0 | 7·25 | 24 | 36 | 5 | 8 |

The lighter drugs are constructed of English oak, the 25 ton drug of African oak; each consists of a platform over a fore and hind carriage. The fore carriage locks under, and its trucks as well as those of the hind carriage, except in the 25 ton gun drug, are of cast-iron. In the 25 ton gun drug the hind trucks are really wheels special class, No. 170, the front trucks are of wood, plated, metal bouched, and shod with 8″ ring tires.

The platform is formed by two longitudinal pieces, connected together in a gun drug, and by four in any other nature; in the large drug, and in the 5 ton gun drug the platform is fitted with iron standards, and in the 25 ton gun drug, with two moveable wooden bolsters, the rear bolster, which the second coil of the gun rests upon, varying in depth according to the nature of the gun.

The small and medium drugs are fitted for man draught; the large drugs with frame shafts for double draught; the 5 ton drug with frame shafts for single draught, and the 25 ton drug with two pairs of frame shafts, and outriggers for four horses abreast.* The latter drug has drag washers with loops sufficiently large to take the hook of a parbuckle rope, and also eye bolts on the front bolster; over each of the hind trucks is a wooden brake, worked by a screw (Fig. 91), and, attached by a chain to the axletree,

Fig. 91.



* The shafts of gun drugs are adapted for farmer's draught.

is a roller to scotch the truck; a scraper to prevent mud accumulating beneath the brakes is also fixed on the rear end of each side.

Drugs are fit to travel only on hard and good roads.

## Sleighs.*

Sleighs

Sleighs are used in conjunction with rollers for moving guns of 18 tons and upwards.

There are two patterns: one for transporting guns up to 25 tons, the other for guns up to 38 tons. Besides these, a few of special patterns have been made for certain stations.

Sleigh to 25 tons. L. of C., § 1663.

The former sleigh is made of African oak or teak, and consists of two side pieces connected by three wood transoms, and secured together by five bolts with keys, at 30″ apart; the ends of the sides are bound with iron hoops and their lower edges are shod with angle iron. The sleigh is fitted with two bolsters for the muzzle and cascable of the gun to rest on.

Three rollers of African oak, hooped with iron and pierced with holes to receive the ends of iron-pointed levers, are issued with each sleigh; the rollers are 8′ long and 12″ in diameter.

It is usually necessary to place 3″ planks for the rollers to run upon. The weight of the sleigh is 59 cwt. 1½ qrs., and its tonnage 4·35 tons.

Sleigh to 38 tons. L. of C., § 3287.

This sleigh is similar in construction and materials to the former, but differs from it in the following respects:—

The sides are 15″ deep, instead of 12″, and the ends have each a recess to form a bearing for a lifting jack when required. It has four transoms, but no bolsters, the gun being supported by skidding. Seven rollers are issued with each sleigh; 3 of 12″ diameter, 7′ long, hooped, and having 2 holes and a staple plate at each end; and 4 of 8″ diameter, 2′ long; the latter for moving the parts of the sleigh itself.

The weight of the sleigh is 51¾ cwts. and of the rollers 11¾ cwts. The tonnage of the sleigh and four short rollers is 3·406 tons; and of the three long rollers, 0·525 ton.

## Carriage for Transporting 38 Ton Guns up Inclines.

Carriage for transporting 38-ton guns up inclines.

This consists of two portions, or cradles, each a strong iron framework. The hind cradle is shaped to receive the bolsters for the breech of the gun. It runs on two cast-iron wheels, the soles of which are broad, and are grooved, so that they may be suitable for a flat surface or for rails, the gauge of the latter being 4′ 8½″.

It contains the brake gear.

---

* For future manufacture both the sleighs above mentioned will be replaced by a shortened sleigh 12′ long for guns up to 45 tons. This sleigh is not fitted with bolsters. § 5118. § 5149.

Four rollers each 7′ long and 1′ diameter and four 2′ long and 8″ diameter are issued with the sleighs.

Steel rollers 8′ long and 8″ diameter will be issued for heavy guns when specially ordered.

The long sleighs will be shortened locally.

The fore cradle rests on an under carriage, which runs on wheels similar to those of the hind cradle, it is connected to the under carriage by a main-pin; a socket for an iron-pointed lever is jointed to the under carriage, ropes leading right and left being attached to its small end to guide the carriage when on a road.

When used on rails, the cradle is locked to the under carriage by a pin in front, and the socket for the lever is replaced by a loop to which tackle can be fixed.

The front cradle is connected with the hind by two longitudinal bars of wrought-iron, which pass through slots in the front and rear of each, and are secured by pins; they can be adjusted in length when required.

The brake gear is as follows:—

Along the centre line of the roadway a plank is secured, and two ropes (about 9″), which are made fast at the top of the incline, pass underneath the carriage, one on each side of the plank.

Each of these ropes passes between a bracket riveted to the bottom of the hind cradle, and a movable block, which is so bolted to the cradle as to be capable of motion towards or away from the fixed bracket. The opposite faces of these brackets and blocks are grooved to suit the rope. The ropes are kept in line with the grooves by guide rollers with hollow soles in front and rear of the brackets.

The movable blocks are connected by a shaft with right and left handed screws cut on its ends, which work in similar female screws in the blocks. At the middle of this shaft is a compound sprocket wheel formed by three parallel plates with angular teeth, the teeth however being omitted on a portion of the circumference, and this portion lies close over the plank in the roadway.

The hindmost teeth are pressed down on the plank by a weighted lever on each side, and they are drawn along it as the carriage moves up the incline; but should the carriage slip backwards, the teeth bite in the plank, causing the shaft to revolve, and forcing the movable blocks against the fixed brackets, so gripping the ropes, which then take the strain, and stop the downward motion. Should it be required to move the gun backwards, the levers can be reversed.

Brakes, on the principle of Allen's brake, are also fitted in rear of the hind trucks, to skid them when on rails.

The weights are as follows:—

| | | cwts. | qrs. | lbs. |
|---|---|---|---|---|
| Cradle { front .. .. .. | | 51 | 2 | 0 |
| Cradle { rear .. .. .. | | 48 | 2 | 20 |
| Bars, connecting .. .. .. | | 5 | 2 | 13 |
| Lever, iron-pointed.. .. .. | | 0 | 1 | 9 |
| | | 106 | 0 | 14 |

## Sling Wagons and Carts.

The sling wagons and the sling cart in the service are:— Sling wagons and carts.

| Nature. | Weight. | Tonnage. | Wheels. Body. Class. | Body. Diameter. | Body. Width of Tire. | Limber. Class. | Limber. Diameter. | Limber. Width of Tire. | Track of Wheels. |
|---|---|---|---|---|---|---|---|---|---|
| | cwts. qrs. lbs. | tons. | | ft. | in. | | ft. | in. | ft. in. |
| Sling wagon, wood, Mark II, to 6 tons | 36 1 0 | 8·27 | A. I. | 7 | 6 | A. II. | 5 | 3 | 6 6 |
| Sling wagon, iron, Mark I, to 7 tons | 44 2 4 | 5·556 | B. I. | 7 | 6 | B. II. | 5 | 3 | 5 11 |
| Sling cart, wood, Mark II, to 3¼ tons | 18 0 0 | 3·95 | A. I. | 5½ | 6 | — | — | — | 5 9 |

Besides the above a few sling wagons have been constructed to take 12 ton guns and also others for 23 ton guns, but no more will be manufactured, and those in store will be retained for use in arsenals.

Wood sling wagon. Mark II to 6 tons. L. of C. § 1636. Construction of body.

The wood sling wagon is of oak, and consists of a body and limber.

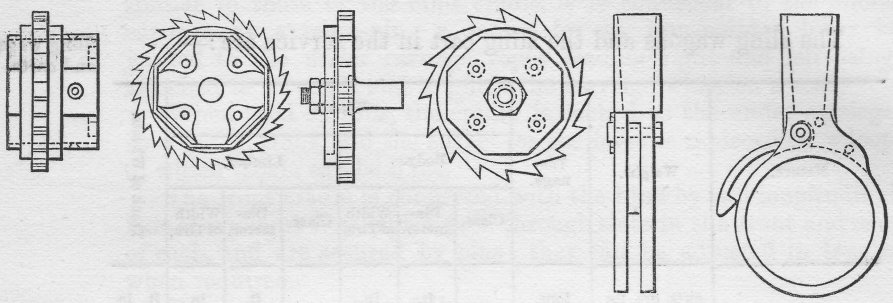
The frame of the body is formed of a perch, two sides, two cross bars, two brackets, and an axletree bed. The perch and sides are housed and bolted across the axletree bed, the sides projecting slightly to the rear beyond the bed. The perch is of greater depth at the middle than at the ends, and it is plated upon its under surface, and has a nose plate with steeled eye, for attachment to the limber, upon its extremity. The front cross bar is secured by a yoke band over the perch, and is bolted to the front ends of the sides, the rear under the perch and sides a little in front of the axletree bed. The brackets for the windlass, which are short and low, are bolted one upon each side immediately over the axletree bed. The lower edges and upper surface of the bed are protected by plates, and the axletree is secured in it by a bolt, by yoke bands, and by clips. The wheels are No. 101, first class A.

Windlass.

The windlass is of elm, cylindrical in the centre with octagonal ends, hooped with iron and pierced with mortise holes to receive wooden pawls. On each end of the windlass is a ratchet arrangement, consisting of a barrel with ratchet ring, two socket rings with socket and pawl, and a ratchet plate with gudgeon.

The barrel, see Fig., is octagonal, of wrought iron (Mark II windlass), made in two parts, and having four lugs upon the inside; its ratchet ring is shrunk upon and riveted to it, the barrel itself fits over the end of the windlass, and is secured to it by screws.

Fig. 92.



The socket rings, on one of which a socket to receive a wooden lever is formed, fit over the barrel, one on each side of the ratchet ring. They are secured together by screws, and are free to move round the barrel, except when the pawl, which is pivoted between them by a pin with washer and keep pin, is caught in the teeth of the ratchet ring, in which case the barrel, and therefore the windlass as a whole, must turn with them. By this arrangement of the socket rings the windlass can be worked continuously.

The ratchet plate has teeth upon its circumference, while through its centre the gudgeon or axle of the windlass passes and is nutted upon the inside. The plate lies upon the end of the windlass, and has upon the inside eight projecting edges, over which an octagon ring is riveted. The ring projects over the end of the barrel, and the plate is secured to the lugs of the latter by screws. The gudgeon projecting from the plate enters a metal gudgeon plate on the bracket of the wagon, where it is secured by a capsquare and key. On each bracket there is pivoted an iron pawl to work in the teeth of the ratchet plate and prevent the windlass turning back.

Upon the centre of the cylindrical part of the windlass there is a hook to take an eye formed in the centre of the gun sling, and upon the axletree bed in front and rear at each side a similar hook or pin to take an eye splice in each end of the sling.

In Mark I windlass, the ratchet arrangement, except the pawls, were of cast instead of wrought iron, the ratchet ring $\frac{1}{2}''$ narrower, and the gudgeon $\frac{1}{2}''$ shorter; such a windlass may readily be recognised by the shape of the teeth, which are curved on the upper side instead of straight. A wagon fitted with Mark I windlass is only capable of transporting a weight up to $4\frac{3}{4}$ tons.

The fittings on the body are two trail handles and a locking plate on each side of the perch; a ring for the attachment of a draught chain, from the limber, underneath the perch; another ring for a drag rope, when required, upon the point above. Upon the inside of each side there is a bearing plate for a movable cleat. There are also fittings on the perch for a drag shoe and chain.

The frame of the limber consists of an axletree bed, a bolster, three futchells, and a splinter bar, connected in the usual manner. A straight pintail with bearing plate is fitted upon the bolster to

receive the trail eye of the body, and a keep chain with hook is attached to the centre futchell. The wheels are No. 14, second class, A. The splinter bar is fitted with a pair of single shafts and with a pair of frame shafts, also with outriggers and swingletrees for four horses abreast. The single shafts can be placed for either single or double draught. A draught chain with tongue and slip ring is attached to a staple upon the rear of the axletree bed.

The following articles, in addition to the windlass, belong to the wagon, namely:— Articles belonging to.

Sling of 5″ white rope, 9′ long from centre to end.

Two sets (of two each) of iron thimbles, respectively 12″ and 9″ in diameter, to fit over the trunnions of gun and take the sling.

One lashing rope of 2½″ tarred rope, 33′ long, to lash the breech of the gun up to the perch.

Four levers of ash, two with a fall each of 2″ tarred rope 15′ long. The levers are each 6′ 8½″ long, oval in section, with square end to enter the sockets, and in Mark II, with the part which enters the socket gradually sloped off instead of cut with a shoulder, as in Mark I.

Two pawls of ash to secure the windlass, when travelling with a weight on it.

A wooden cleat with iron pins to enter the bearing plates on the sides of the wagon. This cleat, when a carriage is carried, enters the trunnion holes and steadies the carriage.

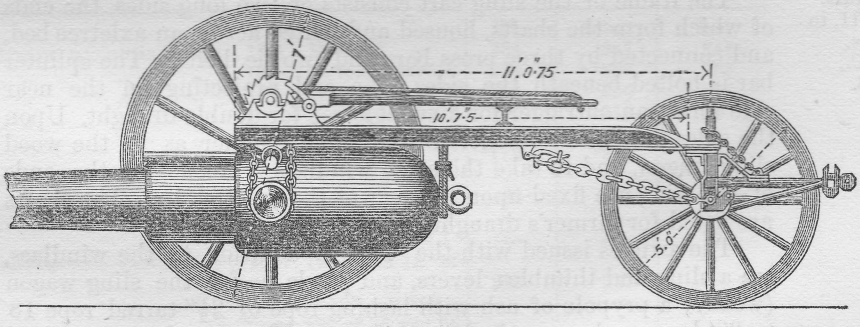
Five swingletrees, No. 1, and a drag-shoe and chain, first class.

Iron sling wagon. Mark I, to 7 tons. L. of C., § 2273. Construction.

The iron sling wagon (Fig. 93) is of the same general form as the wood wagon in the body and limber.

The perch and sides of the body are of girder iron, and are connected by a cross piece, also of girder iron, riveted over them in front, and by the axle riveted to them in rear, a stay of round iron being added from the perch to each side. The axle is in one piece, arched in the body and has projecting from it in the centre two

Fig. 93.




lugs, which lie along the web of the perch, and through which the rivets connecting it to the latter pass; also, at each shoulder a projecting piece which lies under, and by which it is riveted to the

side. The brackets are of tee iron, and are riveted to the sides, so as to support the windlass immediately over the shoulders of the axletree. The perch is fitted with a nose plate with eye, the plate having lugs projecting from it which lie along the web of the perch, and through which the rivets pass. The wheels are shod with ring tires, and weigh each 6 cwt. 3·785 qrs.; the outer flange of the nave is flush with the end of the pipe box, and both flanges are of wrought iron.

The windlass is similar to that of the wood wagon, but longer, and protected against the sling by iron plates; metal bearings with capsquares are riveted in the brackets to receive its gudgeons, and iron sockets to take the spindles of the pawls.

Fittings. On each end of the body of the axletree there are, in rear, two hooks or studs to take the ends of the sling; each stud has a clip formed upon it, which fits on the axle and is secured by a screw. At the position of the lashing rope the sides of the perch, between the tees, are filled in with wood. The remaining fittings of the body are the same as the wood wagon, except that there are no bearing plates for a movable wood cleat.

Limber. The limber is wholly of iron; its axletree bed is built up by riveting a plate of the proper form to each side of the body of the axletree, the pintail passes down between these plates and screws into the axletree, and a bar corresponding in form to the upper edges of the plates is riveted between the latter, from the pintail on each side to the shoulder of the axletree, thus completing the bed. The futchells, three in number, of tee iron, are riveted to the axletree bed and bolted to the splinter bar. The latter is of plate, trough-shaped, and strengthened by a stay of round iron at each end to the bed. A bearing plate is riveted upon top of the bed, and a stay led from the same part to the centre futchell. The wheels are No. 121, second class B.

The fittings for draught, the keep and draught chains, are as in the wood wagon.

The articles belonging to the wagon are the same as those of the wood wagon, except that the sling is of $\frac{5}{8}$″ chain and 9′ long, and the movable wood cleat is dispensed with.

Sling cart. Mark II, to 3¼ tons. L. of C., § 1636. The frame of the sling cart consists of two long sides, the ends of which form the shafts, housed and bolted across an axletree bed, and connected by three cross bars and two tie bolts. The splinter bar is bolted beneath the sides; the end projecting on the near side forms an outrigger for a swingletree for double draught. Upon the sides are bolted brackets in the same manner as in the wood sling wagon, and to take the same windlass. Hooks for the ends of the sling are fixed upon the rear of the axletree bed. The shafts are fitted for farmer's draught.

The articles issued with the cart, in addition to the windlass, are a sling and thimbles, levers, and pawls, as for the sling wagon (wood); a prypole of ash with lashing rope of 2½″ tarred rope 18′ to 30′ long, and one swingletree, No. 1. The prypole is bent and is placed from the rear over the axletree bed and under the rear cross bar, so that the breech of a gun when slung can be lashed up to it.

Mark I cart could only transport 56 cwt., as the windlass had cast-iron fittings.

### Trench Cart (See p. 78).

### Hand Cart.

Hand cart.

The hand cart is similar to the trench cart, but of lighter construction and with No. 44, third class A wheels, 4′ 2″ diameter. It will take a load of 15 cwt., its weight is 4¾ cwt., and its tonnage 1·25 tons. Two slats are issued with it for man draught.

This cart is frequently fitted with a pole with cross handle for man draught, instead of shafts.

### Low Cart for Heavy Projectiles.

Cart for heavy projectiles.

The frame of this cart is of angle iron with two summers of tee iron; it is boarded over and has low sides and a front of plate riveted to it. The axletree is third class and is secured beneath the sides by clips bolted to the latter. The wheels are No. 138, third class A, 4′ 2″ in diameter, with 5″ ring tire, they weigh each 1 cwt. 2 qrs. 22 lbs., and have a track of 4′ 5½″.

The cart is fitted with a pole, with cross handle, for man draught, beneath the pole is an iron prop, and under the rear of the cart two more similar props.

Across the bottom of the cart are wooden battens to steady the projectiles carried; a loading plank (weight 2½ qrs.) is issued with the carts.

### Barrows.

Barrows.

Wrought-iron barrows are used for transporting projectiles for 10″ guns and upwards in batteries and gun floors; wood barrows are used for 7″ and 9″ guns, and also for all natures of heavy guns in magazines and shell rooms.

Special barrows are used for 7″ and 9″ guns mounted on Moncrieff carriages.

The following are the barrows and trucks for projectiles:—

| | Weight. | Tonnage. | Track of wheels. |
|---|---|---|---|
| | lbs. | tons. | ins. |
| Barrow, projectile, R.M.L., 12·5″, Mark II .. | 234 | ·247 | 24½ |
| ,, ,, ,, 12″ of 35 tons, Mark I | 224 | ·289 | 23¾ |
| ,, ,, ,, 11″ of 25 tons, Mark III | 165 | ·256 | 21½ |
| ,, ,, ,, 10″ of 18 tons, Mark III | 160 | ·215 | 19 |
| ,, ,, ,, 12·5″ wood, also 12″ of 35 tons, Mark I .. | 112 | ·249 | 19½ |
| *,, ,, ,, 12″ 25 tons wood, also 11″ to 7″, Mark I .. | 62 | ·125 | 14½ |
| Truck ,, Moncrieff, R.M.L., 9″, Mark I | — | — | 16½ |
| ,, ,, ,, ,, 7″, Mark I | — | — | 17⅛ |
| Barrow ,, road, R.M.L., 12·5″ and 12″ of 35 tons, Mark I .. .. | 280 | ·527 | — |
| ,, ,, shingle, B.L., 12″, R.M.L., 12·5″ and 12″ of 25 and 35 tons, Mark I .. .. | 700 | 1·435 | — |

* This barrow also takes the projectiles of the B.L. 8″ and 9·2″.

Iron barrows. L. of C., § 3652.

The iron barrows are generally similar. They are formed of two side pieces of tee iron, bent outwards towards the middle to admit the selvagee, and prolonged to form handles which are fitted with knuckle guards. They are connected by cross pieces curved downwards to receive the projectile, the front piece having a vertical flange to prevent the projectile slipping off the barrow: the sides are supported over the axles by stays of flat iron. The barrows run on four metal trucks or wheels, the two front lie inside the stays, and are 6″ in diameter for all; the hind wheels are outside the stays, those of the barrows for 18 and 25 ton guns are 11″ in diameter, and for 35 and 38 ton guns 16″.

§ 4250. Since September, 1882, the wheels of the above barrows have been fitted with indiarubber tires. Recesses are cut in the soles of the wheels into which the india-rubber tires are inserted.

| | | | Tires. | |
|---|---|---|---|---|
| | | | Width. | Thickness. |
| | | | ins. | ins. |
| Indiarubber tires | barrows, wrought iron | front wheel | 2·5 | $\frac{9}{16}$ |
| | | hind wheel | 2·0 | $\frac{9}{16}$ |

Barrows for Moncrieff carriages.

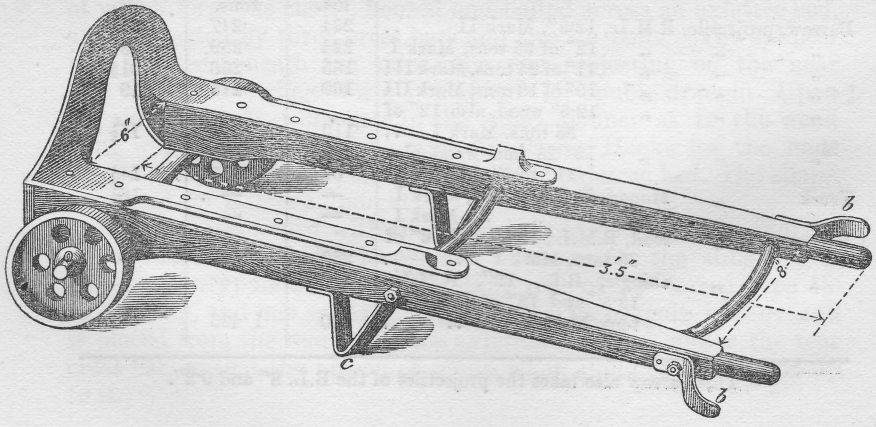
The truck for transporting projectiles for 7″ guns mounted on Moncrieff carriages consists of a bent iron plate, upon which the projectile lies lengthwise, secured by a steadying piece riveted at each side, supported by stays over a straight iron axle on two iron wheels. The truck has an iron tee-shaped handle; the wheels are 1′ 6″ in diameter.

The truck barrow for 9″ projectiles for guns mounted on Moncrieff carriages is similar to the preceding, but has guides to receive the studs of the projectiles, so that, the selvagee being under it, it may be in the correct position for loading. The axle is bent and the wheels are 1′ 8″ in diameter.

Wood barrows.

The wood barrow (Fig. 94) 7″ R.B.L. to 12″ 25 ton R.M.L.

Fig. 94.



projectiles consists of two oak sides connected by two bent tie bolts, and by a head plate which is extended along each side, and upon which the projectile lies.

An iron axle is bolted beneath the sides, and is fitted with metal trucks, 7″ in diameter and 1½″ wide in the sole.

Iron knuckle guards are fixed on the handles and iron feet beneath the sides.

L. of C., § 3400.

The wood barrow for projectiles for 35 and 38 ton guns is similar to the preceding, but larger and stronger, and the trucks are 8″ in diameter and 3″ wide in the sole. The iron feet are made longer, so as to raise the handles to about 2′ from the ground. The head plate is also differently shaped to admit of its being placed under the projectile when fitted with a gas-check. A leather strap 2″ wide is fixed on the left side, and a buckle on the right side, to secure the projectile on the barrow.

The trucks of the wood barrows are fitted with indiarubber tires similar to those on the iron barrows.

| | | Tires. | |
|---|---|---|---|
| | | Width. | Thickness. |
| | | ins. | ins. |
| Indiarubber tires | barrow, 12″ and 12·5″ .. .. .. | 2 | ⅝ |
| | wood, 7″ to 12″ .. .. .. | 1 | ½ |

Road barrow. § 4039.

The road barrow, Fig. 95, is of wrought iron, with wood wheels, and is arranged to carry one projectile for the 35 ton or the 38 ton gun, either vertically or horizontally. The sides are formed of tee iron, with a boss at the front for the insertion of an axle arm and a recess to support the bearer carrying the projectile. The sides are kept in position by two transoms and a diagonal stay. The bearer for carrying the projectile horizontally consists of a pair of malleable cast steel jaws (*a*) pressed against the projectile by the right and left hand screws (*b*) and supported in the recesses (*c*); it is suitable for the projectiles of either 35 or 38 ton guns. The bearer for carrying the projectile vertically consists of a steel band (*d*) which is passed over the projectile and tightened by the screw (*e*). The projectile and band (*d*) are supported by the trunnions (*f*, *f*) in the recesses (*c*) on the barrow. The band for projectiles for 35 ton guns is 12″ internal diameter, and that for projectiles for 38 ton guns is 12·5″.

This barrow is also suitable for the projectiles of the B.L. 12″ gun.

The wheels are No. 77 special class, 2′ 6″ diameter and 1·75″ in width of tire.

Shingle barrow. §4453.

This barrow Fig. 96, consists of two sides jointed to a supporting frame A, to which axletree arms are bolted.

Each side is formed of a bent bar of tee iron and is 5′ 6″ long, they are connected by a cross bar and are riveted together at the

Fig. 95.

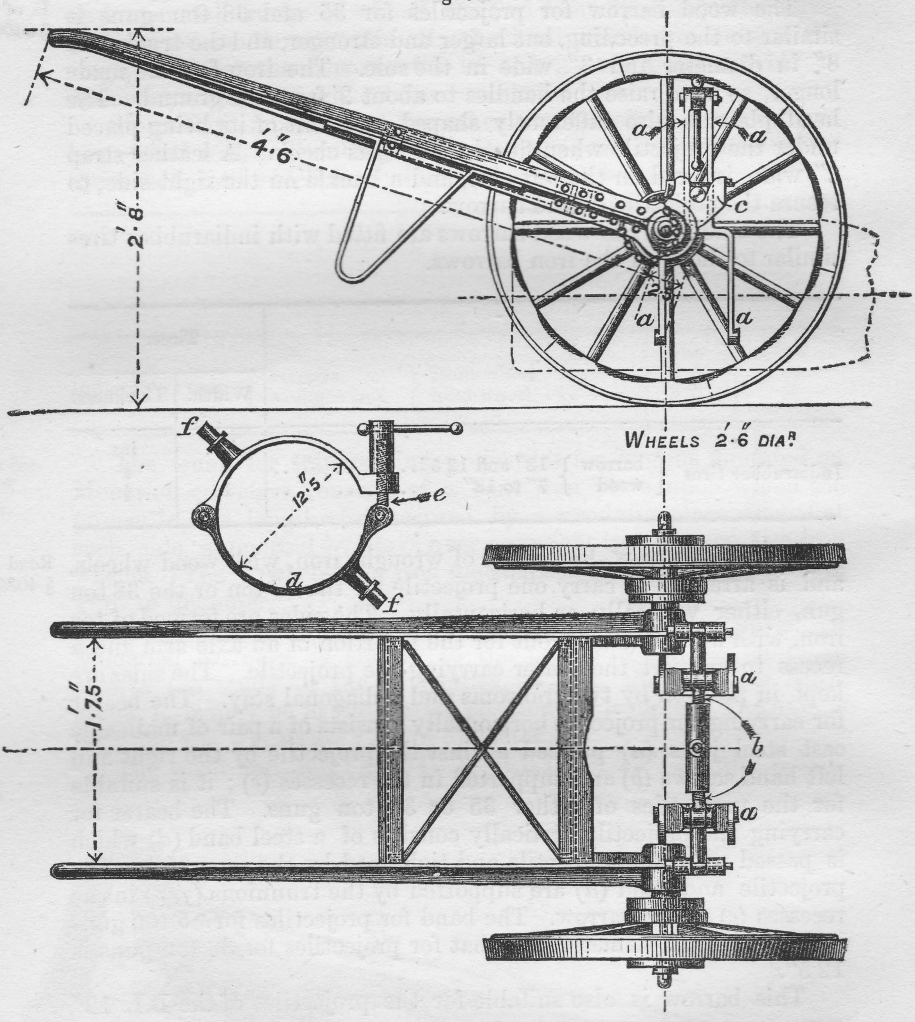
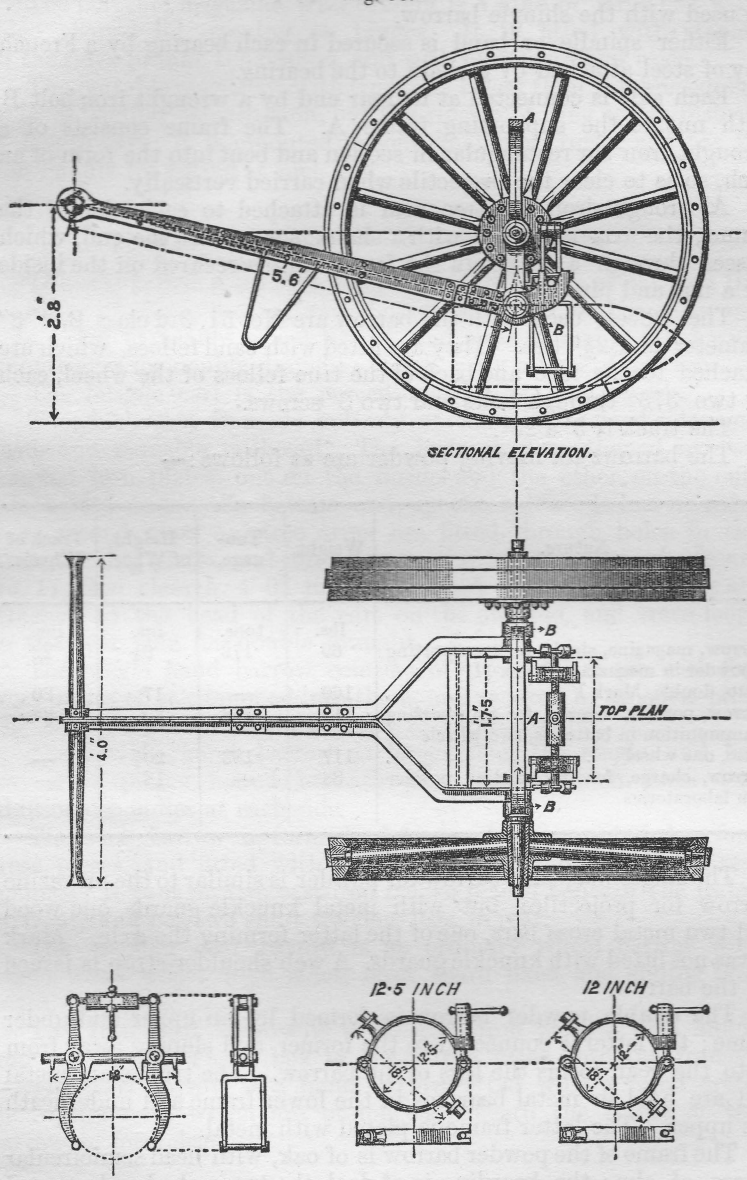


Fig. 96.




front to form a perch; the front end is formed into an eye in which a handle of ash 4′ long is secured by screws.

A leg of wrought-iron is riveted underneath the perch.

A wrought iron bearing for the spindle supporting the projectile bearer is riveted to the rear end of each side. This spindle and

bearer is identical with that for the road barrow. The band used with the road barrow for carrying the projectile vertically can also be used with the shingle barrow.

Either spindle or band is secured in each bearing by a French key of steel attached by a chain to the bearing.

Each side is connected at its rear end by a wrought iron bolt B, with nut to the supporting frame A. The frame consists of a wrought-iron bar rectangular in section and bent into the form of an arch, so as to clear the projectile when carried vertically.

A wrought-iron axletree arm is attached to each side of the frame; the arm is formed with a shank, screwed at the end, which passes through a socket in the frame, and is secured on the inside by a nut and pin.

The wheels used with the barrow are No. 51, 3rd class B, 4′ 8″ diameter and 2½″ tire. They are fitted with sand felloes, which are attached to the face and back of the true felloes of the wheel, each by two ·375″ through bolts and two 3″ screws.

The track is 3′ 4·25″.

The barrows for moving powder are as follows:—

Barrows for moving powder.

| Nature. | Weight. | Tonnage. | Height of Wheel. | Track of Wheels. |
|---|---|---|---|---|
| | lbs. | tons. | ins. | ins. |
| Barrow, magazine, single, for transporting powder in magazines, Mark II | 69 | ·172 | 9½ | 22 |
| Ditto, double, Mark I .. .. .. | 160 | — | 17 | 20 |
| Barrow, powder, covered, for transporting ammunition in batteries, two wheels | 115 | ·182 | 30 | 22 |
| Ditto, one wheel .. .. .. .. | 117 | ·182 | 20½ | — |
| Barrow, charge, for transporting powder in laboratories | 88 | — | 18 | — |

Single magazine barrow for powder. Mark II.

The single magazine barrow for powder is similar to the magazine barrow for projectiles, but with metal knuckle guards, one wood and two metal cross bars, one of the latter forming the axle. Mark I was not fitted with knuckle guards. A web shoulder-strap is issued for the barrow.

Double magazine barrow for powder.

The double powder barrow is formed by an upper and under frame; the latter is connected to the former, and sloping away from it to the rear, forms the legs of the barrow. The trucks are metal and are held in metal bearings in the lower frame and underneath the upper. The latter frame is plated with metal.

Covered powder barrow with two wheels.

The frame of the powder barrow is of oak, with head semicircular pieces of elm; the boarding is of deal, the top arched and covered with canvas and the end closed by folding doors. The interior nails and fittings are of copper. The barrow has an iron axle, wheels No. 76, special class 2′ 6″ in diameter, and drag washers; the rear is supported by two wooden legs.

## Portable Magazines.

Magazine, portable, with bearers.

The portable magazine, with bearers, is a kind of large box with ridge shaped lid opening on hinges. It is fitted with staples on the sides to take the bearers, and with cleats to stand upon.

Magazine, portable, with trucks.

The portable magazine, with trucks, is larger than the preceding; it is of similar construction, but the ridge roof runs across instead of lengthways; it is mounted on four small elm trucks, and has an iron handle for lifting at each end.

## Miscellaneous Carts and Barrows.

Miscellaneous carts and barrows.

Coal cart.

The coal cart is a tip cart, the frame of which is of oak and the boarding of deal; floating rave boards are fitted on the sides and head. The cart takes wheel No. 15, 2nd class A, and is fitted with an outrigger for double draught: it will carry a load of one ton.

Fatigue cart.

The fatigue cart is the preceding without rave boards.

Duck cart.

The duck cart is made entirely of oak; it has fixed sides and head, and movable tailboard. The body is strengthened by two cranked iron plates, one on the inside and the other on the outside, bolted across the bottom and up the sides. It has no axletree; second class axletree arms are fitted through holes in the strengthening plates, and nutted upon the inside. The wheels are No. 17, 2nd class A, 4′ 0″ in diameter. A pair of fixed shafts are attached to the head of the cart on the off side, and trace loops on the near side for double draught.

Hand barrow, single.

The single hand barrow consists of two sides of ash with five cross pieces of oak tenoned into them, and secured by wooden pins. The ends of the sides are tapered to form handles.

Hand barrow, double.

The double hand barrow is larger than the single, and has two cross pieces bolted beneath the frame, which form two additional handles at each side.

Sack barrow.

The sack barrow is formed of two sides connected by four cross pieces, and fitted with a high iron head for the load to rest against. It runs on two cast-iron trucks placed beneath the frame in front, and has two short wooden legs in rear.

Coal barrow, wood.

The wooden coal barrow is an ordinary wheel barrow with single wood wheel, high sides, head board fixed and sliding tailboard.

Coal barrow, iron.

The iron coal barrow is a skeleton iron barrow with single iron wheel, and a coal box of sheet iron fitted into the frame.

Turf barrow.

The turf barrow is a hand barrow fitted with a wood crate, the uprights of which are prolonged beneath the frame of the barrow to form legs.

# CHAPTER XV.—MACHINES.

## TACKLES.

Tackles.

A tackle consists of one or more blocks with a fall of rope.

Blocks, Admiralty.

Blocks are of two descriptions, Admiralty and Bothway's; and of each description there are single, double, and treble blocks, so named according to the number of sheaves.

An Admiralty "rope strapped" block consists of a shell of elm, a sheaf or sheaves of wood or metal with iron pin, a rope strap, an iron hook with thimble, and an iron thimble or rope loop. The pin passes through the centre of the shell and sheaves, furnishing a support for the latter to revolve upon in the former. The rope strap is spliced round the shell, attaching the hook to the latter at one end, and the thimble or loop at the other.

Blocks, Bothway's.

A Bothway block consists of a shell *a*, Fig. 97, of elm, one or more metal sheaves *f*, with iron pin *o*, two or more wrought-iron straps *d*, according to the number of sheaves, and a shackle *h*, with swivel hook *l*, and pin *n*; in addition to these parts, in the smaller natures there is a small shackle with thimble and pin for the attachment of the standing end of the fall; in the larger natures the latter is made fast to a button *o*, formed on the head of the pin supporting the sheaves.

Fig. 97.

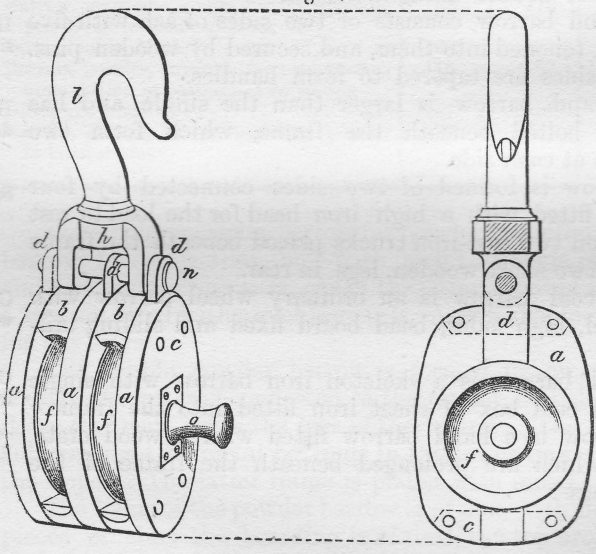
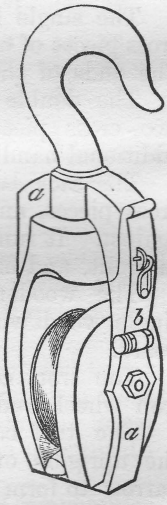



Fig. 98.



The shell is in parts held together by four rivets *c*, and the straps pass down through it on either side of each sheaf. The pin supporting the sheaves passes through the straps so that they and not the shell, as in the rope-strapped blocks, support the weight or strain. The ends of the straps project beyond the top of the block for the attachment of the shackle with its hook, a pin secured by a key forming the connexion. The hook can revolve in the shackle; the former in the latest pattern blocks is stronger than in the first pattern, being of greater width and depth of section at the bearing part. If the block is fitted with a thimble the straps project beyond the lower end, and have the small shackle with its thimble attached to them in the same manner as the larger at their other extremities. The metal sheaves are now made of phosphor bronze (the same as used for pipe boxes of wheels), and to distinguish them are stamped with the letters "P. B." on the boss; the pin used with such sheaves is case-hardened and stamped with the letter "H." L. of C. § 2790.

Blocks, whether Admiralty or Bothway's, single, double or treble, are distinguished by the length of the shell in inches, which is stamped upon it. Admiralty blocks are "single" or "double" 3″, 4″, &c., up to 9″, "treble" 6″, 7″, 8″, 9″; Bothway's are 8″, 10″, 12″, 15″, and 18″, either single, double, or treble, and 21″ treble only.*

Snatch blocks.

A snatch block (Fig. 98) is an "iron-bound" Admiralty single block, the iron strap being made to open at one side with a hinge, so that a rope can be placed in it without the necessity of reeving it from its end.

Snatch blocks are 8″, 10″, 12″, 15″, and 21″; the 21″ block has the strap inside, like a Bothway's block. 15″, 18″, and 21″ snatch blocks have now sheaves of phosphor bronze.

The size of rope which a block with a wood shell will take may be ascertained by dividing the length of the block or its size by 3.

Natures of tackles.

The principal natures of tackles are as follows:—

A "whip;" one single 8″ block with fall.

A "luff-tackle;" one single and one double 8″ block with 14-fathom fall of $2\frac{1}{2}$″ tarred rope.

A "gun tackle;" two double 8″ Admiralty blocks, with $12\frac{1}{2}$-fathom fall of $2\frac{1}{2}$″ white rope (for use with 7″ R.B.L. and 68-pr. S.B.), or one double and one treble 9″ Admiralty block with 16 fathoms of 3″ white rope (for use with R.M.L. heavy guns).

A "gyn tackle;" two treble 12″ Bothway's blocks, with 18-fathom fall of 4″ white rope (for light gyns), or, two treble 15″ Bothway's blocks with 18-fathom fall of 5″ rope (for heavy gyns).

A "sheers tackle;" two treble 18″ Bothway's blocks with 113-fathom fall of 6″ white rope, or two 21″ Bothway's blocks with fall of 7″ rope.

---

* The latest patterns of Bothway blocks are Mark II, of 8″, 10′ and 12″; Mark IV of 15″; Mark III of 18″; and Mark I of 21″.

Special tackle for mounting guns in casemates. L. of C., § 3308.

For mounting guns up to 25 tons in casemates special tackle is approved.

To lift the cascable of the gun there are two treble 18″ Bothway blocks, with special shackles, one for attachment to an eyebolt in the crown of the arch of the casemate, the other for attachment to the cascable loop, rove with a fall of 15 fathoms of 6″ white rope. To lift the chase there is a tackle on each side consisting of two treble 12″ Bothway blocks rove with a fall of 12 fathoms of 4″ rope. The upper blocks have special shackles made to swivel, and are attached to eyebolts in the crown of the arch; the lower blocks also have special shackles, and are attached by means of other separate shackles to the end of a short wire rope sling, with thimble spliced into its ends, which passes under the gun.

Weight of breech tackle complete, 4 cwts. 2 qrs. 17 lbs. Weight of two muzzle tackles complete, 3 cwts. 1 qr. 15 lbs. Weight of wire rope sling, with shackles, 2 qrs. 7 lbs.

## Slings.

The following are the slings now issued, and the purposes for which they are used :—

Slings. L. of C., § 3421. § 4069.

| | | Weight. | | |
|---|---|---|---|---|
| Chain. | | cwts. | qrs. | lbs. |
| 1″ link 12 fathoms .. .. | Raising 12 ton guns with one tackle | | | |
| Breech and muzzle with triangular links and shackles Mark II. | Raising 12 ton gun with one, or 18 or 25 ton guns with two tackles.. | 5 | 0 | 0 |
| White Rope. | | | | |
| 1. 9″ 16 ft. long .. .. | Raising 12 ton guns with one tackle, and slinging 35 and 38 ton guns at half weight mark .. | 0 | 3 | 5 |
| 2. 9″ 7 ft. long, fitted with thimble .. .. .. | For use at half weight mark, when slinging 12 to 25 ton guns with two tackles .. .. .. | 0 | 2 | 1 |
| 3. 9″ 3 ft. long, fitted with thimble .. .. .. | For use at cascable, in conjunction with preceding one .. .. | 0 | 1 | 10 |
| 4. 7″ 14 ft. 6 in. long .. | Raising guns of 7 tons with one tackle .. .. .. .. | 0 | 1 | 20 |
| 5. 6″, 12 ft. 6 in. long .. | Raising guns of 5 tons and under .. | 0 | 1 | 3 |
| 6. Thimble, wrought iron, circular (two to a set) | For sling 16 ft. .. .. .. | 0 | 0 | 24 |

Chain slings. Plate LI. L. of C., § 2782.

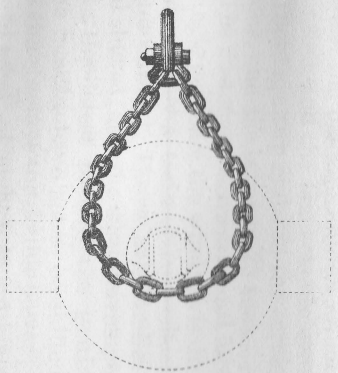
The "breech and muzzle" chain slings consist of two common link chains, two triangular connecting links of $2\frac{1}{4}$″ round iron, measuring $7\frac{3}{4}$″ inside from base to apex, and three shackles (two 6″ and one 9″) each with a 2″ bolt and nut. Weight complete, 5 cwts.

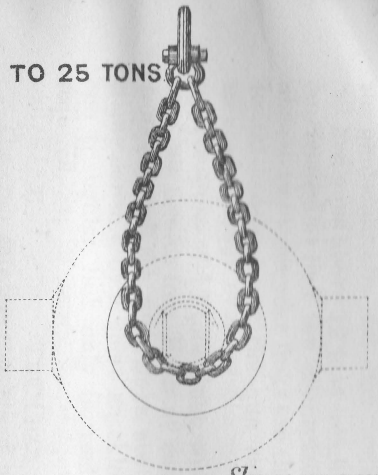
The breech sling consists of a length of $1\frac{1}{4}$″ common short link chain, with two longer links of $1\frac{3}{8}$″ iron at each end. Total length, 12′ 4″.

The muzzle sling is similar to that for the breech, but each end is arranged with three long links of $1\frac{3}{8}$″ iron, three short links of $1\frac{1}{4}$″ iron, and finally at the extreme end, one medium link, identical with those on the ends of the breech sling. Total length, 13′ $7\frac{1}{4}$″.

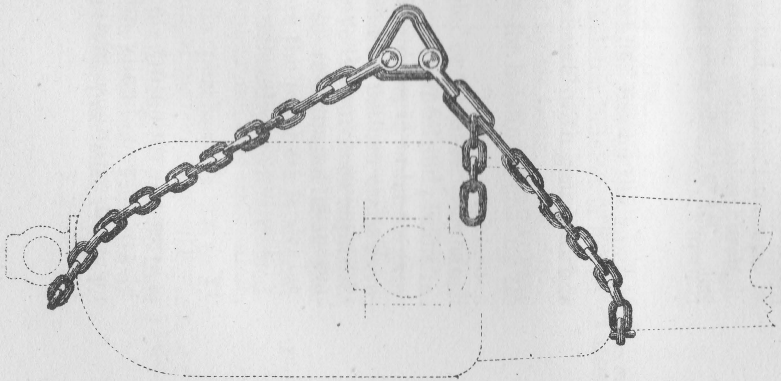
# SLINGS, CHAIN, FOR LIFTING GUNS FROM 12 TO 25 TONS.

## MARK II.

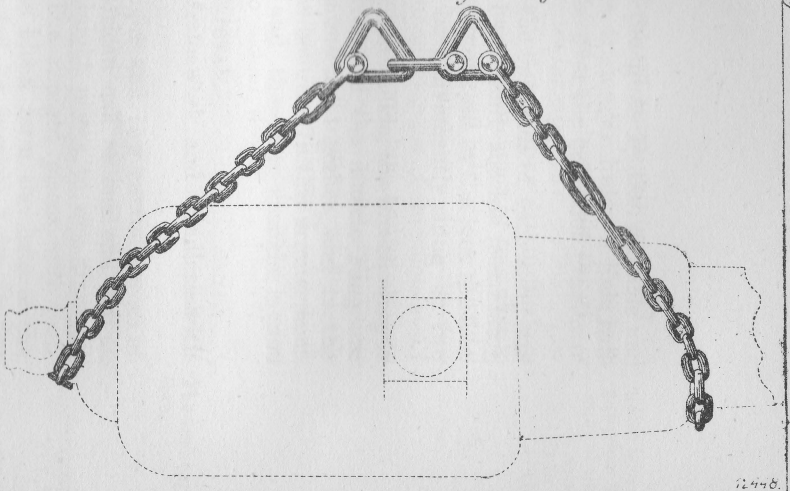




*Slings arranged on 9 in. 12 ton Gun.*



*Slings arranged on 10 in. 18 ton Gun*



To face page 326.

12446.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN.

The slings are arranged to lift the guns by the cascable and chase, and so that the centre of the triangular links or link, into which the tackles are hooked, shall be over the centre of gravity of the gun.

For guns above 12 tons weight, the two ends of each sling and one triangular link are connected by a short shackle (see Plate), and the two triangular links are then connected by the long shackle. By this arrangement the gun can be conveniently slung by two tackles.

For guns of 12 tons slung with one tackle, the breech sling is used as before, four links at each end of the muzzle sling are dropped, and the fifth links are connected together, and to the triangular link by a short shackle as before. In this arrangement one triangular link only is used, and the long shackle is not required.

### The Crab Capstan.

The crab capstan consists of a framework and windlass with two capstan bars. The crab capstan.

The frame is formed of two straight and two curved pieces of oak scantling bolted to a block of African oak at one end, and at the other to transoms; the two straight pieces to one transom, and the two curved to another. The straight pieces with their transom and the under side of the block form the base of the capstan. The transoms are connected by vertical bolts, in the lower there is a gudgeon socket, and in the upper a recess with capsquare to secure the windlass. The latter is of elm, and stands upright in the frame, the lower part, round which the rope is passed, is conical, the upper part cylindrical, with holes through which the capstan bars, which are of ash or rock elm, 16′ long, are passed.

### Iron Crabs for Hoisting Guns.

Iron crabs consist of an oak frame which lies on the ground, and upon each side of which a cast-iron skeleton bracket is bolted. Between the brackets an iron windlass or barrel with gear to drive it is fitted, and the brackets are connected by tie bolts. Iron crabs. § 4159.

There are two crabs in the service, one for hoisting guns up to 50 tons, and the other to 25 tons.

The 25-ton crabs are arranged for "single" or "double" purchase; for single purchase the windlass is driven by one wheel and pinion, in the double by a train of two wheels and pinions, in order to gain greater power. The winch handles in the first pattern crabs have to be shifted, and the wheels arranged to give the purchase required.

In the latest pattern the gearing is so re-arranged that the winch handles have not to be shifted where the purchase is altered from the single to the double power; the handles also are lengthened so as to admit of eight men working.

The gain of power when used in single purchase is 24 to 1, and in double purchase, 72 to 1. L. of C., § 3480.

The 50 ton crabs, for use with sheers for lifting 35 and 38 ton guns, are arranged for either double or treble purchase. The gain of power in double purchase is $46\frac{2}{3}$ to 1, and in treble purchase, 140 to 1.

## Triangle Gyns.

Triangle gyns are designated either as wood or tubular; the latter are constructed either of wrought iron, or in the case of those made since January, 1886, of steel.

The following are the gyns for garrison service.

| Nature. | Weight. | Tonnage. | Diameter of Spar. | Diameter of Bolt. |
|---|---|---|---|---|
| | cwts. qrs. lbs. | tons. | ins. | ins. |
| 18 ft. light wood, Mark II. to 7 tons* ... ... | 14 1 7 | 1·57 | 7 | 1½ |
| 18 ft. ,, ,, ,, III. to 7 tons ... ... | | | | |
| 18 ft. heavy ,, ,, II. to 12 tons† ... ... | 26 2 19 | 2·07 | 9 | 2 |
| 18 ft. ,, ,, ,, III. to 12 tons ... ... | | | | |
| 18 ft. light tubular ,, I. to 7 tons* ... ... | 14 2 18 | 1·275 | 4½ | 1⅝ |
| 18 ft. ,, ,, ,, II. to 7 tons* ... ... | 15 3 18 | 1·304 | 4½ | 2½ |
| 18 ft. heavy ,, ,, I. to 12 tons† ... ... | 27 2 13 | 2·075 | 6½ | 2 |
| 18 ft. ,, ,, ,, II. to 15 tons† ... ... | 27 3 6 | 2·316 | 6½ | 2¾ |

* When the foot of the prypole is 13′ distant from a perpendicular let fall from the centre of the windlass, or 14′ 9″ from the foot of the cheek.

† When the foot of the prypole is 15′ from the perpendicular from the windlass, or 16′ 10″ from the cheek.

**Light wood gyn. Mark II.**

The gyn consists of two cheeks with cross bars, a prypole, a windlass, and a shackle with bolt and key.

The prypole and cheeks are of Riga fir spars, the top shod with iron cap plates, and the lower ends hooped and fitted each with a collar spike. The shackle bolt connects the upper ends of the cheeks and prypole, passing through the caps and shackle from the right and being keyed on the left. The lower ends of the cheeks are connected by two iron cross bars, the windlass gudgeons rest in cast-iron sockets in cleats of African oak, which are secured one on the inside of each cheek by hoops and rivets.

The shackle and its bolt are of wrought iron; the upper block of the tackle is hooked to the former, point to the prypole.

The windlass is on the same plan as that of the sling wagon or cart, the ironwork being identical in the light gyn with that of the latter windlass. In Mark I light gyn, as in the wagon and cart, the fittings were of cast iron, and this gyn could only take a weight up to 6 tons.

The articles belonging to the gyn are as follows:—

One gyn tackle of two treble 12″ blocks, and 4″ fall.
Four levers, two with ropes, the same as for the sling wagon.
Three wood trucks for the feet to rest in if required.
Two slings of 7″ white rope 14′ 6″ long.

In Mark III wood gyns the prypole is fitted at the head, with a forked socket, similar to the head of the prypole of a tubular gyn. The shackle bolt passes through holes in the socket; the upper block of the tackle is hooked directly to the bolt, a shackle not being required.

**Heavy wood gyn. (R.C.D. photo-litho-graph, 72a.)**

The construction of the heavy wood gyn is the same as that of the light, but two link loops are added, one in each cheek, to take

a handspike for a man to mount upon to reach the upper block of the tackle, and the prypole is fitted with an eye to take the hook of the block of an erecting tackle. The windlass is the same as that of the light gyn, except that the sockets are larger.

The articles belonging to the heavy gyn are :—

A gyn tackle of two 15″ treble blocks with 5″ fall.
An erecting tackle of one single 8″ Admiralty block with 7-fathom fall of 2½″ white rope, by which to raise the main tackle for placing it after the gyn is in position.
Three wood trucks, as for light gyn.
Four levers, two with three ropes each, larger in section than those for the light gyn.
Three slings of 9″ white rope, viz., one long sling 16′, one sling of 7′, and one sling of 3′ ; the two latter each fitted with a thimble, and also with a grummet of 3″ tarred rope, which closes the sides of the sling upon the gun.
One lashing rope of 3″ bolt rope, 10 yards long.

Light and heavy tubular gyns. Mark II. Plate LII. L. of C., § 2895. § 4923.

The light and heavy tubular gyns consist of the same parts as the wood gyns, the cheeks and prypole are of wrought iron, or since January, 1886, of steel, tubing, the former are straight throughout as in the wooden gyns, and have a cap shrunk on each end, the lower cap fitted with a spike. The prypole is arched at the upper end, the end of the bent part being formed by a solid forging welded into the tube ; the end of the bent part is forked, having holes in it for the bolt which connects the cheeks and prypole together. By this arrangement a shackle is unnecessary and the upper block is hooked upon the bolt, giving thus a higher lift. The lower end of the prypole is fitted with a cap similarly to the cheeks. The sockets for the gudgeons of the windlass and for the pawl spindles are made with iron bands, which pass round the cheeks and are secured by bolts.

The heavy iron gyn has no link loops for a handspike, but has a third connecting bar instead.

The articles belonging to each gyn are the same as for the corresponding wood gyn, except that the heavy gyn has an 8′ lever for the prypole, and no erecting tackle.

Light and heavy tubular gyns. Mark I.

In Mark I tubular gyns the prypole is straight and a shackle is used as in the wooden gyns ; the heavy gyn is fitted with an erecting tackle. Gyns of this pattern are altered to Mark II pattern as opportunity offers.

## Gibraltar Gyns.

Gibraltar gyn. R.C.D. Photo-Litho. 73.

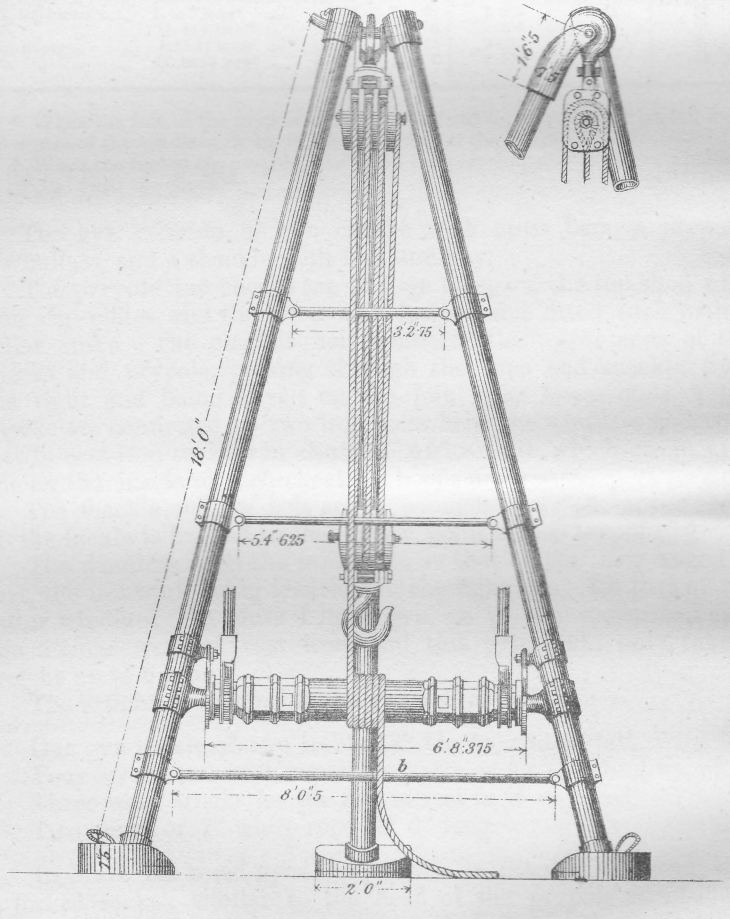
The Gibraltar gyn is constructed for mounting guns in case-mates or other confined situations. It is made of oak, and consists of a frame mounted on four trucks, and fitted with a ratchet windlass and tackle.

Frame.

The frame is formed of two standards, a cross bar, and two axletree beds.

Standards.

The feet of the standards are mortised into the beds, and






Dangerfield. Lith. 22. Bedford St. Covent Garden.

supported by a wooden prop on each side; the upper ends are mortised into the cross bar, and secured to it by plate-iron stays.

Cross bar. The centre of the cross bar is fitted with three gun-metal sheaves, with an eye beneath, forming a fixed treble block; and an iron plate is bolted on each side to strengthen it. The rear end of the cross bar, which projects beyond the top of the standard, is fitted with a single sheave, over which the fall is led.

Axletree beds. The axletree beds are fitted with iron axletrees, and are mounted on four cast-iron trucks one foot in diameter. They are connected together by a wrought-iron bar bolted to the rear axletree bed, and fitting over a hook in the front axletree. This bar prevents the standards from separating when the weight is taken by the gyn.

Ratchet windlass. The windlass consists of a barrel, ratchet plate, and toothed wheel working on a spindle between two cast-iron brackets bolted to the rear standard, A pinion wheel fitted on a spindle beneath, and turned by an iron handle on each side, works in the tooth wheel and causes the barrel to revolve. A pawl is fitted to the bracket over the ratchet plate.

Tackle. The tackle consists of one treble 12″ block with 8 fathoms of 3½″ white rope. The block is of wrought iron fitted with three metal sheaves, and has a wrought-iron bar 1′ 8″ long attached to it, to which the weight to be raised is lashed.

Fall. The end of the fall is attached to the eye bolt beneath the cross bar, and is rove through the block and round the sheaves in the cross bar, then out through the top of the gyn, over the sheave in the end of the bar, and down to the barrel of the windlass beneath.

The height of this gyn on its trucks is 7′ 6″ in the clear.

It will raise a weight of three tons.

## Sheers.

Spars for sheers are of the best Baltic fir: for a 12 ton gun they are 40′ or 45′ long and 16″ or 17″ in diameter at the centre respectively; for a 25 ton gun 45′ or 60′ long and 20″ in diameter at the centre. One spar is fitted with cleats of elm 2′ apart. Spars 70′ long and 30″ in diameter are used for 35 and 38 ton guns.

L. of C., § 3480. Special sheers are also approved to lift up to 7 tons. The spars are 40′ in length, and are connected at the top by a bolt with collars and keys, which is fitted with a shackle for the lifting tackle, and two shackles for guy ropes. Each spar is fitted with a cap plate through which the bolt passes, and with a hoop at top and bottom, having an oval ring on each side for attachment of guys and foot ropes. Weight 31¾ cwts.

Sheers for 25-ton guns and upwards are secured at the head by a bolt, with shoulders, keyed outside each spar. The bolt passes through iron caps upon the spars, and is formed to take the hook of a short chain by which each main tackle is suspended and also, between the hooks, shackles for the attachment of the guys. The latter are of wire rope in 30′ lengths, a band with two rings is fitted to the top and foot of each spar.

The following special stores are approved for use with heavy sheers. For guns of 18 and 25 tons :— Tackle for use with heavy sheers. L. of C., § 3481.

2 chains, $1\frac{1}{2}''$, $12\frac{1}{2}$ fathoms long, with 5″ rings welded into each end, for holdfasts.

2 chains, 1″, $12\frac{1}{2}$ fathoms, with shackles, for holdfasts.

Guys of $5\frac{1}{2}''$ wire rope, in six 30′ lengths with thimbles, and 8 shackles and bolts.

4 heavy shackles to take 18″ blocks at holdfasts.

Thimbles for 9″ slings, if required for head of sheers.

For guns of 35 and 38 tons :—

4 chains, $\frac{3}{4}''$, $12\frac{1}{2}$ fathoms, with rings, for holdfasts.

2 chains, $1\frac{1}{2}''$, $12\frac{1}{2}$ fathoms, and 2 chains, 1″, with shackles for each and thimbles to take the hooks of 21″ blocks, for holdfasts for guys, and leading blocks.

Guys of 7″ wire rope, in eight 30′ lengths with thimbles, and 10 shackles and bolts.

### Derrick.

A derrick is used for raising heavy sheers, and consists of one spar 35′ long and 12′ in diameter at the foot, with shoe for foot, tackle, &c. Derrick.

### Apparatus for lifting 38 ton guns.

There are three patterns of this apparatus; the "Sliema," for use in low-roofed casemates where a lifting beam cannot be employed; the "Hurst," for ordinary bomb-proof casemates and open works; and the "small port." § 3433.

The Sliema pattern consists of three main screws, each with two spherical nuts, one nut of each pair having a steel pin and split key; three bent bolts each with two conical nuts; three washer plates, and three plates supporting washer plates. Sliema pattern.

Each main screw passes through a hole in one of three plates which are fixed to the roof of the casemate, so as to be respectively over the trunnions and cascable of the gun. The screw is supported by one of its spherical nuts, which rests on the plate, and which is secured to the screw by the pin and key. The lower end of the screw passes through a hole in one of the washer plates, which is supported on the second spherical nut of the screw. One of the bent bolts, is suspended from this plate, its ends passing through two holes in the plate and being secured by the conical nuts. These bent bolts form loops in which the trunnion studs and cascable rest. The supporting plates are intended to fit inside the bent bolts, and keep the washer plates in position, when not supported by the nuts of the main screws.

Two iron stands for hydraulic jacks and three steel tommies for the lower nuts of the main screws are required for use with the apparatus.

The stand consists of a wrought iron plate $2' \times 2' \times 1''$ on which the foot of the jack rests. This plate is connected by four stays, with a wrought-iron bracket which is formed to fit round the cylinder of the jack. A wrought-iron clip bolted to the bracket

secures the cylinder, the foot of the ram being steadied by four screw studs on the lower plate.

The tommy is 10·5″ long and ·625″ diameter.

**Hurst pattern.** The Hurst pattern apparatus consists of a wood frame supporting a wrought-iron box beam from which the gun is suspended.

The wooden frame is formed of two upright sides, 8′ 7″ apart, connected at the top by a cross beam and tie bars.

Each side consists of two teak or pitch pine posts 10″ square, the lower ends of which fit into recesses in a wrought-iron base plate or shoe; their upper ends also fit into recesses in a wrought-iron cap. The posts of the sides are 2′ 0½″ apart, to allow the end of the box beam to project between them, and to move up or down.

The box beam is built up of wrought-iron, and is 11′ 3″ long; it is curved upwards at the middle to clear the gun. It is suspended from the caps of the sides by 3″ main screws, 5′ long, which pass through holes in strong washer plates on the caps, and are supported by spherical nuts with flat lock nuts over them. These screws also pass through holes in the box beam, and the latter rests on other spherical nuts on the screws.

The gun is suspended from the box beam by two bent bolts, which fit under the trunnion studs, and whose ends pass through the beam, and are secured by spherical nuts above.

Two stands and twenty wood blocks are required for the hydraulic jacks; and two tommies for the lower nuts of the main screws.

In works where washer plates can be fixed to the roof, such as Spitbank Fort, the wood frame and blocks are dispensed with; but in all other respects the gear is as above described.

**Small port pattern.** The small port pattern apparatus consists of an upper and lower suspending bar of wrought-iron; two bent bolts, one for the upper bar with four hexagonal nuts, and one for the cascable with two spherical nuts two connecting bolts, with two spherical nuts, and one pin; and a brass pad.

The upper bar is suspended by the bent bolt to the rear loop bolt in the roof of the casemate, the nuts on the bent bolts being screwed up until the ends of the bar bear against the under side of the roof girders to the right and left of it. The brass pad is inserted between the bent bolt and the roof bolt to give better bearing.

The connecting bolts pass through the upper bar, and are nutted on the upper side of it, the nuts being pinned to the bolts. The lower ends of the bolts pass through the lower bar, and are nutted on the under side of it.

The cascable bent bolt which is formed to fit round the cascable button of the gun, is suspended from the centre of the lower bar. Inside the bent bolt is fitted a wood block which is shaped to suit the upper side of the cascable button.

Two stands for steadying hydraulic jacks are required for use with the gear.

### Lifting Jacks.

The lifting jacks in the service are:—the screw jacks with ratchet head and lever, described p. 103; Tangye's hydraulic jacks of 7½, 15, and 22½ tons; and the G.S. hydraulic jacks of 10, 20, and 30 tons.

Tangye's hydraulic jacks are designated by their working loads, viz., 7½, 15 and 22½ tons. Plate LIII. § 3619.

They were formerly distinguished by their proof loads, which are 10, 20, and 30 tons respectively, but are now ordered to be called by their working loads, which are three-fourths of the proof loads.

They are all generally alike in external form.

Each jack consists of the following principal parts: a ram, *a* (Plate LIV, Fig. 1): ram cylinder, *b*; reservoir, *c*; and pump, *d*.

The rams, cylinders, and reservoirs of all differ but little from each other except in dimensions; the pumps of the 7½ and 15 ton jacks are also alike, but that of the 22½ ton jack is differently arranged. The following is a description of the 15 ton jack, which is equally applicable to the 7½ ton.

The ram is of wrought iron, cylindrical, with an oblong base upon which it stands.

The cylinder is of cast steel; it fits over and slides upon the ram. On its lower extremity a claw is formed, to take the weight if required, and at the same end there is a feather on the inside held by a screw, which works in a slot along the ram, and prevents the cylinder turning round under a load.

To prevent water passing down between the ram and the cylinder, a cup-shaped leather packing, *e*, Fig. 1, is secured on the top of the former by a washer and screw.

The reservoir is of cast steel, the upper part square in horizontal section: the lower part fits tightly round the top of the cylinder, on to which it is driven by hydraulic pressure. It is closed at the top by a cap secured by two screws, and on this the weight to be raised can rest. There is a small screw in one side of the cap, which closes a passage leading to the interior of the reservoir; before working the jack the screw must be loosened to admit air. In jacks of later patterns there is in one side of the reservoir a filling hole closed by a screw. The working load is shown on a metal plate.

In some of the earlier jacks the cap screwed into the reservoir, and the latter screwed on to the cylinder; and in the 7½ ton jacks the reservoir was of cast iron, and the cylinder of wrought iron.

The pump is of metal, and screws into the top of the cylinder. There are two varieties of pump used in the 7½ and 15 ton jacks; in those of the latest pattern the arrangement for lowering the weight is in the pump, and is worked by the same lever that works the pump; in jacks having pumps of the earlier pattern the lowering is accomplished by a separate screw plug.

Fig. 2 shows a pump of the present pattern. The upper part is cylindrical internally, and in this space the plunger, *f*, moves up and down. A vertical channel leads downwards from this space to a small chamber, *g*, beneath, in which is the outlet valve, *h*; this is conical in form, and being pressed upwards by a spiral spring, closes the lower end of the channel; it has a spindle, or stalk, which passes up through the channel; this latter acts as a guide to it, and the stalk is grooved longitudinally to allow the water to pass. The spiral spring rests on a plug screwed into the bottom of the pump,

# JACKS, LIFTING, HYDRAULIC, TANGYE'S.





## 7½ TONS

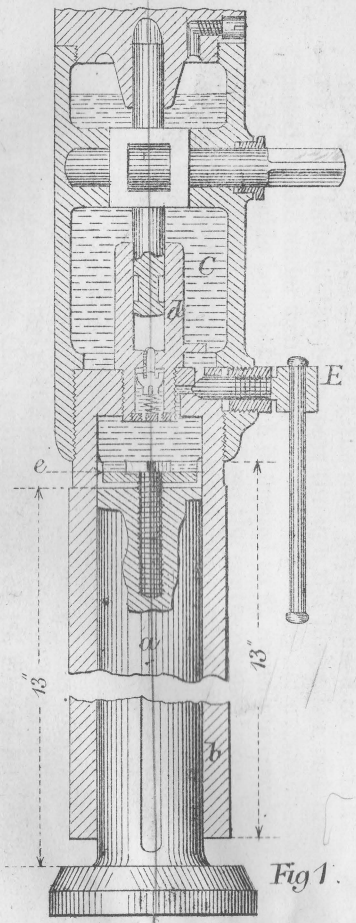



Fig 1.

## 15 TONS

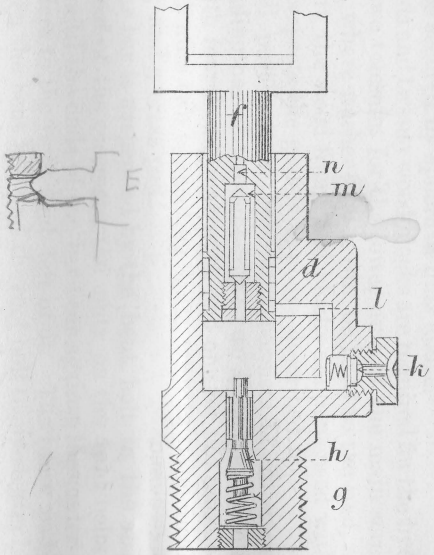



Fig 2.

## 22½ TONS.

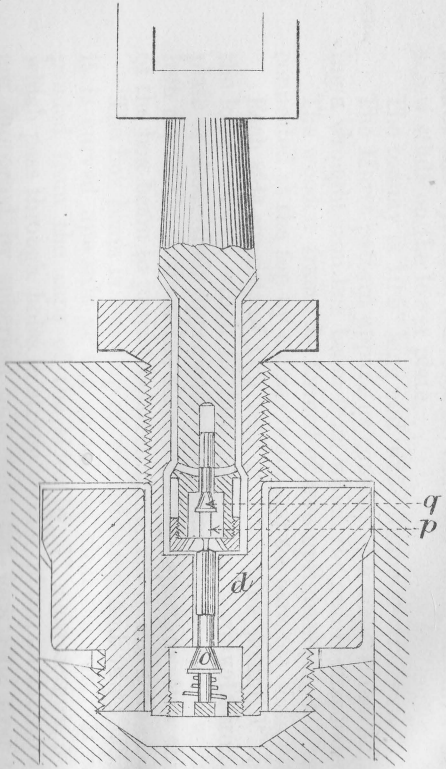



Fig 3.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN.

12448.

and in this is a hole, through which the fluid passes into or out of the cylinder.

At the bottom of the cylindrical space in the pump there is also a side hole, which communicates with another small chamber containing the inlet valve, *k*, which is also conical, and is kept in its place by a spiral spring in the chamber, but it opens by pressure from without. A cap of wire gauze is tied on over it, to prevent the ingress of dirt.

The plunger is worked by a small crank on a spindle supported in bearings formed in the sides of the reservoir, and which is moved by a lever outside; it is guided by its upper part being prolonged into a recess in the cap (see Fig. 1). A leather packing is fitted round it, so that it may work watertight in the pump.

The action of the pump is as follsws:—

When the plunger, *f*, Fig. 2, is raised the pressure of the atmosphere on the fluid in the reservoir opens the inlet valve, *k*, and the fluid passes into the interior of the pump. When the plunger is forced down, its pressure on the fluid in the pump opens the outlet valve, *h*, and the fluid is driven into the ram cylinder. To make room for itself there, the ram resting on the ground, it raises the cylinder and reservoir with the weight on the latter, exerting a force greater than the pressure of the plunger in the proportion of the area of the top of the ram to that of the bottom of the plunger.

To prevent the jack being pumped too high, there is a small hole in the cylinder near the lower end, which allows the fluid to escape when the head of the ram reaches that point.

To lower the load, it is only necessary to allow the fluid to escape from the cylinder back into the reservoir.

To do this, the lever is moved partially off the spindle, until it can pass a stop on the side of the reservoir, and then being forced down the plunger presses the stalk of the outlet valve, *h*, which projects a little into the body of the pump, thus allowing the fluid to pass back from the cylinder into the pump, and so into the chamber containing the inlet valve, *k*; from thence it goes by the passage, *l*, in the metal of the pump, and along a groove in the side of the plunger, *f*, back into the reservoir, *c*, Fig. 1.

In working the lever for raising a weight, the stop on the reservoir prevents its being pushed so far down that the plunger would touch the outlet valve, and also the groove in the plunger does not extend far enough down to communicate with the passage *l*, in this case.

To enable the plunger to move down the pump far enough for lowering without its being necessary to force more water into the cylinder, a chamber, *m*, is formed in the plunger, which communicates by a small passage, *n*, through the plunger with the reservoir, and is closed at the bottom by a plug with a hole in it. In this chamber is a double acting valve.

When the jack is worked this valve in the up-stroke closes the hole in the plug, so that no fluid can get down, and in the down stroke it is jerked up, and closes the passage leading up from the

chamber, so that no fluid can get up; but if the lever be merely pressed, it is not jerked up but only lifted off its seat, and the fluid flows round it into the chamber, and up through the passage into the reservoir. The plunger can thus descend without causing any pressure on the ram, until it presses the stalk of the outlet valve, and lowering takes place.

A pump of the earlier pattern is shown in the 7½ ton jack, Fig. 1. In these the action in raising a load is the same as that just described, but there is no arrangement for lowering; the outlet valve is cup-shaped, and has a leather seating, and the plunger is solid.

For lowering, a screw plug, E, which closes a channel through the top of the cylinder for the purpose, is loosened by means of its lever handle, to allow the fluid to flow back into the reservoir.

The pump of the 22½ ton jack is shown at Fig. 3. In this the outlet valve, *o*, is similar to that of the others in arrangement and action, both in working and lowering; the inlet valve is in the plunger.

In the latter is a chamber, *p*, and leading upwards from this is short vertical passage, from which two cross channels lead to grooves in the outside of the plunger on opposite sides. In the chamber is the inlet valve, *q*, conical in form, and guided by a ribbed stalk, which works in a hole drilled in the plunger.

The valve is free to move up or down, and in the up-stroke fluid can pass freely along the grooves and chamber in the plunger into the pump; but in the down-stroke the valve is jerked upwards, closing the passage leading to the grooves, and so preventing any fluid passing up.

For lowering, no special arrangement is necessary to allow the plunger to descend in the pump to touch the outlet valve; and when it does so the grooves in the plunger reach down to an enlargement of the interior of the pump (the position shown in the figure) so that the fluid can pass back to the reservoir without having to pass through the interior of the plunger, otherwise the rush of water would shut the inlet valve, and so stop the lowering.

In order to make a fluid-tight joint where the lever spindle enters the reservoir, there is round the former a metal packing gland, with a leather washer underneath; the same is the case with the lowering screw-plug where it exists. There is also a washer under the air-hole screw.

The 15 ton jack is fitted with a portable foot secured by four screws to give it an increased base, and both it and the 22½ ton jack are fitted with handles.

A spanner with tommy is issued with each of Tangye's jacks for removing the pump. It is of steel bent to suit the form of the jack; at the centre are two holes at right angles to each other to take the tommy or lever also of steel. The same spanner serves for all natures.

## G.S. Hydraulic Jacks.

4261. R.C.D. photo-lithograph 79A. Plate LIV.

These jacks are similar in general form and internal arrangement.

The ram R, Fig. 1, Plate L, consists of a hollow cylinder of steel, which is screwed into a reservoir S of M.C.I.

An external casing for the ram F, is also screwed into the reservoir. A wrought-iron claw C is shrunk on the lower end of the casing and at each side there is a wrought-iron handle I attached by a rivet T to a stud.

The lower end of the ram is fitted with a gun-metal pump Q. A leather packing *f* is secured at the base of the ram by the metal nut M, which is screwed on to the pump. The metal outlet valve *d* fits in the lower part of the pump, it is kept in action by the metal spring Z, and is secured in position by the metal cap B, which screws into the nut M.

The plunger P is of steel; it is connected by a steel stud *b*, secured by a taper steel pin N to a steel crank D, on a steel spindle Y supported in bearings in the reservoir. The plunger is fitted with a leather packing ring *g*; in a cavity at the base of the plunger, closed by a metal screw cap A, is the inlet valve of metal *c*.

The spindle Y is formed with a socket at one end for the lever which is of wrought-iron.

The ram cylinder E of steel is screwed into a M.C.I. foot H, and is fitted with a leather *e* kept in position by a metal disc G.

At the top of the reservoir there is an air hole closed by a wrought-iron screw plug W with leather washer. By this hole the jack can be filled or emptied. The lever has a screw-driver formed on one end of it for use in removing this screw.

### Action of the Jack.

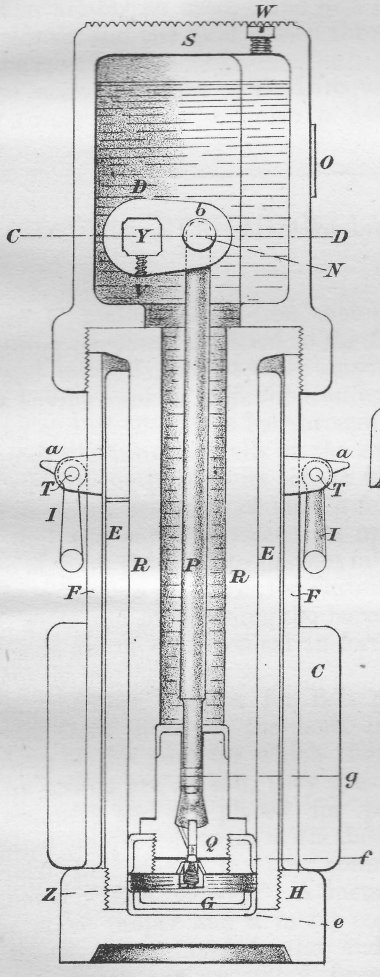
The lever acting upon the crank D through the spindle Y, raises and lowers the plunger P. By the up stroke of the latter, a vacuum is created in the pump Q and the pressure of the air in the reservoir forces the fluid past the inlet valve *c* in the plunger; at the down stroke the inlet valve *c* closes and the outlet *d* opening, the fluid is forced from the pump under the ram, thus raising it with the load. A small hole limits the height of lift, by allowing the fluid to escape when the ram leather passes it.

To lower, the lever is shifted in the socket so as to bring its shoulder upwards, and then pressed gently downwards until the plunger touches the valve *d*. It is then forced down to its full extent which opens the outlet valve *d* and allows the fluid in the cylinder to escape through the space round the plunger P in this position back to the reservoir.

The weights of the hydraulic jacks now in the service are:—

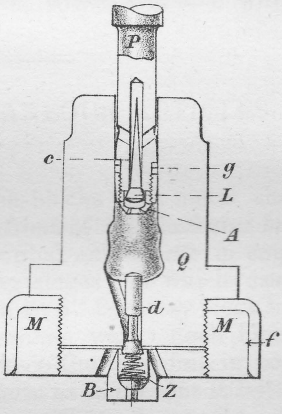
| | | | lbs. |
|---|---|---|---|
| Tangye's | 7½ ton | .. .. .. | 89 |
| | 15 „ | with foot.. .. | 173 |
| | 22½ | .. .. .. | 166 |

FIG. 1.




VERTICAL SECTION
THROUGH A.B.

FIG. 3.




VERTICAL SECTION.
THROUGH PLUNGER & PUMP.

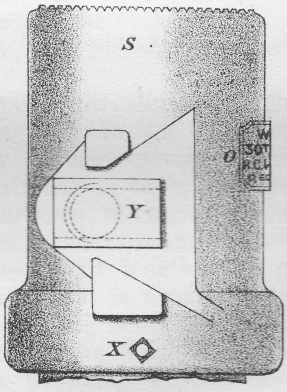



FIG. 2.
SIDE ELEVATION
OF PART OF JACK.



DANGERFIELD. LITH. 22, BEDFORD ST. COVENT GARDEN.

| | | lbs. |
|---|---|---|
| General Service | 10 .. .. .. .. | 148 |
| | 20 .. .. .. .. | 271 |
| | 30 .. .. .. .. | 414 |
| Rear Roller Jack | .. .. .. .. | 175 |

### Care of Hydraulic Jacks.

Hydraulic jacks should be invariably kept filled with the authorised fluid. Whatever be the fluid, in filling it the filter, p. 340, should invariably be used. The jack should be cleaned out every three months and the fluid passed through the filter when returning it to the reservoir.

The jacks should be worked frequently and always left either under a weight or in the frame p. 340, where available when not in use.

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## CHAPTER XVI.—MISCELLANEOUS ARTICLES.

**Blocks, snatch, loading tackle.**

Two 5″ malleable cast-iron snatch-blocks with metal sheaves, for loading purposes, are fitted to the front of all platforms for 10″ guns and upwards, except those mounted *en barbette* in emplacements having sunken ways for loading stages; in which case the running end of the fall is led through an 8″ Bothway block hooked into an eye let into the walls of the sunken way. Each block has a flat steel spring fixed to its side to keep the rope fall in position, while its joints are made of such a form as to prevent it falling so as to foul the carriage when run up. The earlier pattern blocks had no stop on the joint to prevent falling (see Fig. 69A, page 231).

**Brushes, piasaba.**

These brushes are used for cleaning the bores of R.M.L. and R.B.L. guns and for cleaning the bores and chambers of B.L. guns. The heads are of elm, conical in form, with piasaba grass secured in them by marine glue.

The chamber brushes for B.L. guns are slightly larger in diameter than those for the bore, in order to suit the powder chambers of the guns for which they are respectively intended.

The staves are of ash, they are similar to those for sponges and rammers and are placed for purposes of nomenclature in the same numbered series with them. For certain natures of ordnance the staves can be connected to lengthening pieces designated "End Staves." A metal socket is fitted to the end of the stave proper and a metal connecting screw which screws into the socket is fitted to the end of the lengthening stave. The two parts are prevented from becoming unscrewed by a sliding bolt fitted to the lengthening stave, which is acted on by a spring and enters a loop formed on the socket of the stave proper.

The following table gives the dimensions of the staves for the brushes in the service:—

§ 4032.
§ 4246.
§ 4955.

| Nature. | | | Total length, including portion in Brush. | Fitted in brush. | | | | Diameter at | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Length. | | Diameter (*a*). | | Head. | Point. |
| | | | ft. in. | ins. | ins. | ins. | ins. | ins. | ins. |
| B.L. | Bore | 12″ | 15 10·25 | 2 | 5 | 2·5 | 2 | 3 | 3·25 |
| | | 9·2″ | 11 10·75 | — | 3·5 | 2·125 | 1·625 | 2·25 | 2·25 |
| | | 8″ | 11 7·5 | — | 3 | 2·125 | 1·625 | 2·25 | 2·25 |
| | | 6″ | 15 5 | 2 | 3·0 | 1·875 | 1·125 | 1·875 | 1·25 |
| | | 5″ | 6 11·5 | — | 4·5 | — | 1 | 1·875 | 1·25 |
| | | 4″ 22 cwt. | 10 2·5 | — | 3·25 | — | 1·00 | 1·625 | 1·25 |
| | | 4″ 13 cwt. | 7 8·75 | — | 3·25 | — | 1·00 | 1·625 | 1·25 |
| | Chamber | 6″ 80-pr., Marks II and III | 5 6 | — | 6·0 | — | 1·5 | 1·875 | 1·5 |
| | | 5″ | 4 9 | — | 6.0 | — | 1·25 | 1·875 | 1·5 |
| | | 4″ 22 cwt. | 4 6 | — | 6·0 | — | 1·25 | 1·625 | 1·25 |
| | | 4″ 13 cwt. | | | | | | | |
| R.B.L. | 7″ | | 11 11 | 2 | 3·0 | 1·875 | 1·25 | 1·875 | 1·25 |
| | 40-pr. | | 11 7·375 | — | 3·375 | — | 1·00 | 1·625 | 1·625 |
| | 20-pr. | | 9 1·5 | — | 3·00 | — | 1·00 | 1·562 | 1·562 |
| R.M.L. | 16″ for end stave | | 28 11 | 3 | 7·00 | 4·00 | 3·00 | 4·00 | 2·25 |
| | 12·5″ | | 18 4 | 2 | 5·00 | 2·125 | 1·625 | 2·25 | 2·25 |
| | 12·5″ for end stave | | 22 1·5 | 2 | 5·0 | 2·125 | 1·625 | 2·125 | 2·00 |
| | 12″ 35 ton | | 15 2 | 2 | 4·5 | 2·125 | 1.625 | 2·25 | 2·125 |
| | 12″ 25 ton | | 13 8·5 | 2 | 4·5 | 2·125 | 1·625 | 2·25 | 1·75 |
| | 11″ | | 13 9 | 2 | 4·5 | 2·125 | 1·625 | 2·25 | 1·75 |
| | 10″ | | 13 11 | 2 | 4·5 | 2·125 | 1·625 | 2·25 | 1·75 |
| | 9″ | | 12 5·25 | 2 | 4·5 | 2·125 | 1·5 | 2·25 | 1·25 |
| | 8″ | | 11 9·5 | 2 | 4·5 | 2·125 | 1·5 | 2·25 | 1·25 |
| | 8″ howitzer, 46 cwt. | | 4 11 | 2 | 4·5 | 2·125 | 1·5 | 2·25 | 1·75 |
| | 7″ | | 12 6·25 | 2 | 3·25 | 1·875 | 1·25 | 1·875 | 1·25 |
| | 80-pr. also 64-pr. | | 10 5 | 2 | 3·00 | 1·875 | 1·125 | 1·875 | 1·25 |
| | 40-pr. | | 9 4·5 | — | 3·5 | — | 1·00 | 1·625 | 1·625 |

Buckets, sponge.

Sponge buckets for garrison service are of wood with rope handles.

Caps, mortar. § 2836.

The caps are made of canvas waterproofed; they are intended to fit over the muzzles of the mortars in order to keep the bores clean and free from water.

Each cap is provided with a leather strap 1″ wide with common single japanned buckle, the strap passes through holes slit near the edge of the cap and is sufficiently long to pass round and secure the cap to the chase of the mortar.

| | Inside dimensions. | | Length of Strap. |
|---|---|---|---|
| | Diameter. | Depth. | |
| | ft. in. | ins. | ft. in. |
| 13″ | 2 2 | 6 | 7 6 |
| 10″ | 1 8½ | 6 | 6 0 |
| 8″ | 1 5 | 6 | 5 0 |
| 5½″ | 0 9 | 5 | 2 9 |
| 4⅖″ | 0 7 | 5 | 2 4 |

Caps, sponge. § 4801.

Sponge caps are made of canvas waterproofed. Each cap is fitted with a string to secure it over the sponge head.

For purposes of nomenclature the caps have been placed in a numbered series. The following table gives the caps in the service,

their dimensions and the nature of ordnance for which they are respectively intended:—

| No. of Cap. | Dimensions in inches. | Nature. |
|---|---|---|
| 1 | $8\frac{3}{4} \times 7\frac{3}{4}$ | $5\frac{1}{2}''$ and $4\frac{2}{5}''$ mortars. |
| 2 | $8 \times 5$ | R.B.L. 6-pr. R.M.L. 2·5″ and S.B. 3-pr. and $4\frac{2}{5}''$ howitzer. |
| 3 | $10 \times 6$ | R.B.L. 12 and 9-pr., R.M.L. 9-pr., also 7-pr. 150, 200, and 224 lbs. |
| 4 | $10\frac{1}{4} \times 6\frac{1}{2}$ | R.M.L. 16 and 13-pr. and S.B. 6-pr. |
| 5 | $11 \times 7\frac{1}{4}$ | B.L. 4″ 13 cwt., R.B.L. 20-pr., R.M.L. 25-pr., S.B. 12 and 9-pr. also 12-pr. howitzer, 18 and 12-pr. carronade. |
| 6 | $11 \times 7\frac{1}{4}$ | This is No. 5 with loop for cleaner, B.L. 12-pr. |
| 7 | $12 \times 9$ | B.L. 4″ 22 cwt., R.B.L. 40-pr., R.M.L. 40-pr. and S.B. 18-pr. also 24 pr. or $5\frac{1}{2}''$ howitzer and 24-pr. carronade. |
| 8 | $14 \times 10\frac{1}{2}$ | B.L. 5″, R.M.L. 80 and 64-pr., S.B. 32 and 24-pr., R.M.L. 6·3″ howitzer and 32-pr. carronade. |
| 9 | $15\frac{1}{4} \times 11\frac{3}{4}$ | B.L. 6″, R.B.L. 7″, R.M.L. 6·6″ gun and howitzer, and 7″ and S.B. 42-pr. |
| 10 | $17\frac{1}{2} \times 12\frac{1}{2}$ | R.M.L. and S.B. 8″ guns and howitzer, S.B. 68-pr. gun and 8″ mortar. |
| 11 | $18 \times 14$ | R.M.L. 9″ and S B. 100-pr. |
| 12 | $17\frac{1}{2} \times 16$ | B.L. 9·2″, R.M.L. 10″ and S.B. 10″ howitzer also 13 and 10″ mortar. |
| 13 | $19 \times 18$ | R.M.L. 11″. |
| 14 | $20\frac{1}{2} \times 20\frac{1}{2}$ | B.L. 12″ 43 tons, R.M.L. 12·5″ and 12″. |
| 15 | $37 \times 29$ | R.M.L. 16″. |

Cases, cartridge.

Leather cartridge cases are designated by numbers from 1 to 7. The leather used for the cases is crop butt, sewn with copper wire. Each case is fitted with a cover of block leather and with a leather covered rope handle. (For R.M.L. guns, two handles).

The following table gives the dimensions of the cases and the natures of ordnance for which they are respectively intended:—

| No. of Case. | Dimensions in inches. | Nature. |
|---|---|---|
| 1 | $9\frac{1}{2} \times 7\frac{1}{8}$ | 13″ L.S. mortar, S.B. 10″ howitzer or mortar. |
| 2 | $15 \times 7\frac{1}{2}$ | R.B.L. 7″ S.B. 68 and 42-pr. and R.M.L. 8″ howitzer. |
| 3 | $16\frac{3}{4} \times 6\frac{11}{16}$ | S.B. 8″ gun. |
| 4 | $14\frac{1}{8} \times 6\frac{5}{16}$ | R.B.L. 40-pr. (L.S.) R.M.L. 80, 64 and 40-pr. 6·3″ howitzer and S.B. 32-pr. 63 to 56 cwt. |
| 5 | $10\frac{3}{4} \times 6\frac{3}{8}$ | R.B.L. 40 and 20-pr., S.B. 32-pr. 50 to 39 cwt., 24-pr. 50 to 48 cwt., and S.B. 8″ howitzer. |
| 6 | $7\frac{1}{2} \times 6\frac{3}{8}$ | R.B.L. 12 and 9-pr., R.M.L. 9 and 7-pr., S.B. 32-pr., 32 or 25 cwt., 24-pr. 20 cwt., 24 and 12-pr. howitzer, 8″, $5\frac{1}{2}''$ and $4\frac{2}{5}''$ mortars, all carronades and smaller natures of guns. |
| 7 | $13\frac{7}{8} \times 8\frac{3}{8}$ | 13″ naval mortar and S.B. 100-pr. |

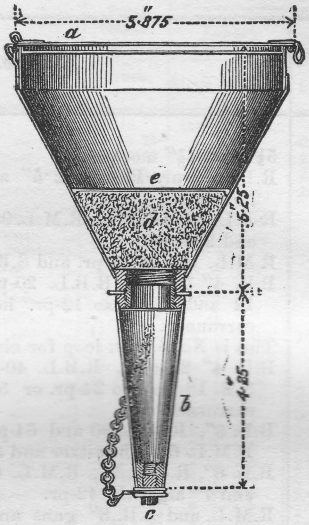
Covers, vent slot.

Covers for vent slots of R.B.L. guns are of canvas waterproofed, lined with serge and attached to a hollow elm block, which enters the slot. They are fitted with straps to secure them.

Filters, hydraulic jack, § 3794.

The filter Fig. 99, consists of a conical tin vessel, with a hinged

Fig. 99.




lid (*a*) and a removable tube (*b*), fitted with a screw plug (*c*) to prevent the entrance of dirt when the filter is not in use.

The lower part of the filter is loosely fitted with a piece of sponge (*d*), over which is soldered a piece of fine wire gauze (*e*).

Weight 1 lb. 7 ozs.

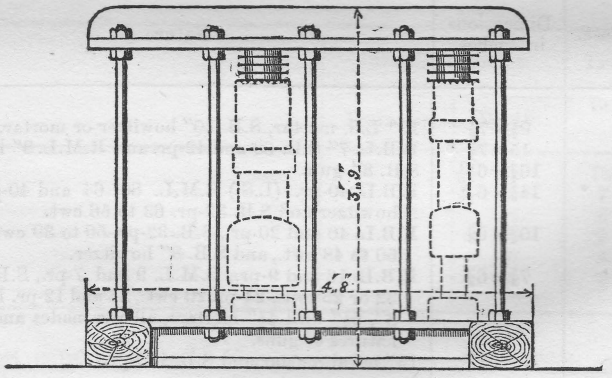
Former, wad.

Wad formers are issued to stations where grummet wads for R.M.L. guns are manufactured; they are flat circular pieces of wood, usually of mahogany, hollowed out and grooved, so that the correct length of rope for the rim of the wad and for the cross piece can be measured, and also the position of the latter ascertained.

Frame, store, hydraulic jack. § 4774.

The frame, Fig. 100, is constructed to keep four jacks stored in a proper condition for immediate use.*

Fig. 100.




* This frame can be made to take the rear roller jack, by putting in a packing block of malleable cast-iron, which is formed to receive the end of the ram of the roller jack. Two felt pads and a galvanised iron parting plate are issued with the block.

It consists of two tee iron bars connected by ten iron stay bolts, the lower bar is fixed in two wooden blocks which form a stand.

The jacks are placed between the bars, and pumped up sufficiently to maintain a moderate pressure on the leather packings, which will preserve them in a condition to prevent leakage.

A pad of felt and iron plates is placed between each jack and the top bar, to keep a constant pressure in the pumps.

Weight 5 cwts.

Fulcrums are of elm 24″ × 8″ × 12″. **Fulcrums.**

Shot garlands are formed of four lengths of angle iron, which overlap each other, and are secured by pins. The pins are universal, and the size of any garland may be increased by connecting additional lengths. **Garlands.**

Garlands for foreign stations are usually made of wood on the spot.

A gasket is a flat plaited cord, an eye at one extremity, and the other usually tapered off. It is made from rope of any size required. **Gaskets.**

Cast-iron hollow cylinders are made as gauges to guide the examination and clipping of sponge heads. They are only issued for the 7″ and 9″ R.M.L. **Gauges for sponge heads.**

Handspikes for garrison service are designated as "common," "metal roller," or "wood roller."

Common handspikes are of ash, the lower ends square and bevelled off at the point, the upper or small ends oval in section, in Mark II, and round in Mark I. They are of three lengths 5′, 6′, and 7′ respectively. **Handspikes.**

Metal roller handspikes or truck levers are used for running up wood sliding carriages on traversing platforms. They are of ash, 7′ long, and are fitted at the point with a plate of iron with a hook and pawl, also two metal trucks one at each side. At the small end they are fitted with a fall of white rope.

Wood roller handspikes are used in running up rear chock carriages. They are of ash, 6′ long; the stave is fitted into an iron socket having two flanges with two rollers of lignum vitæ, working between them on an axle bolt, and secured by a split key. Upon the upper side of the socket a projecting knob is formed which fits into the handspike iron on the carriage.

A set of harness for man draught, consists of two drag ropes of 2½″ white rope 18′ long, each furnished with eight leather covered loops, sixteen web loops with hooks, one web shoulder strap with a short piece of rope at each end. **Harness, man, Mark II, § 2228.**

The web loops are detached from the drag ropes, and can be hooked into the loops on the ropes or unhooked, as may be required.

The shoulder strap is for use in supporting the shafts.

Iron shod levers are designated as "crow" or "platform."

Crow levers are of ash, with an iron claw plate at the point, and are either 6′ or 7′ long. They are used for drawing nails or bolts out of platforms. **Levers, iron shod.**

Platform levers are of ash, beveled at the point and shod with iron; they are either 5′ or 4′ in length, and are used for traversing platforms.

Levers, pointed.

Pointed levers are of ash with iron or steel points. These levers have been placed in a numbered series.

The levers for the Moncrieff carriages have a hole near the point to receive a retaining pin.

No. 1 is 5′ 6″ long, Mark III, and is for use with guns of 25 tons. Its weight is 13½ lbs.

No. 2 is 4′ 0½″ long, Mark III, and is for use with guns under 25 tons. Weight 10 lbs.

No. 3 is 5′ long, Mark I, and is for use with the 10″ R.M.L. small port carriage. Weight 13¼ lbs.

No. 4 is 5′ long, Mark I, and is for use with the 7″ R.B.L. Moncrieff carriage; it is slightly stouter than No. 3, and has a steel point. Weight, 13½ lbs.

No. 5 is 5′ 2¾″ long, Mark I, for 9″ R.M.L. Moncrieff carriages. Weight, 21 lbs.

No. 6, 4′ 4″ long, Mark II, for 7″ R.M.L. Moncrieff carriages Mark II. Weight 20 lbs.

No. 7, 4′ 1″ long, Mark III, for 7″ R.M.L. Moncrieff carriages Mark I. Weight 21 lbs.

Levers, wood.

These are similar in shape to common handspikes. They were formerly made square at the point, but the longer natures, 12′ and 14′ have been beveled like handspikes since October 1883. They are of ash or rock elm, and are 8′, 10′, 12′, and 14′ in length.

Measure, filling hydraulic buffer. § 4374.

This measure is of tin, and when full, contains 1 gallon. There are ribs round the inside surface by which 1 quart, 1 pint, ½ pint, and ¼ pint may be measured.

Pans, drip, hydraulic buffer. § 4028.

These pans are of zinc; they are generally attached to carriages or platforms fitted with hydraulic buffers, underneath the latter in order to receive any drip from the gland or run-off cock. They have been placed in a numbered series.

The following are the pans for Garrison service:—

No. 1. For gland, B.L. 12″, R.M.L. 12·5″ casemate and small port 6′ recoil, and for gland and run-off cock 12·5″ dwarf.

This pan has a fixed cover with a hole in the centre and a screw stoppered emptying hole in one corner. Weight 1 lb. 2 ozs.

No. 2. For run-off cock R.M.L. 12·5″ casemate and small port 6′ recoil.

This pan has a cover similar to that of No. 1, and is fitted with a hanger for suspension from a screw. Weight 1 lb. 2 ozs.

No. 4. Run-off cock, medium platform No. 9.

This pan is similar to No. 1, but is smaller. Weight, 13 ozs.

No. 8. For gland, medium platform, No. 9.

This pan has a cover similar to No. 1, but has no stoppered hole in the corner. It has a spout, which is intended both for emptying the pan, and for catching the drip from the gland. It is fitted with a base plate having two slots, for the bolts securing the pan. Weight 1 lb. 1½ ozs.

No. 11. For gland and run-off cock R.M.L. 12″ 25 tons to 7″. This pan has no cover; it is fitted with two bands having jointed loops and turnbuckles, by which it is suspended from the cock of the buffer. It has a small spout at one corner for emptying. Weight 1 lb.

No. 12. For gland and run-off cock, medium platform No. 6.

This pan has a cover with a hole in the centre. It is fitted with an inclined channel 24″ long, to catch the drip from the buffer during recoil, or when the gun is housed. It is fitted on each side with a hanger, by which it is fixed to the front transom plate of the platform. Weight 3½ lbs. § 4743.

Pedestals for the support of the stool beds of carriages, when the elevating screws are removed are of elm. Pedestals.

Planks for moving guns are 3″ thick and are: of fir, whole 12′ × 9″, 10′ × 17″; half, 5′ × 17″; of oak, whole 10′ × 17″, 10′ × 12″; half, 6′ × 12″, and 4′ × 12″. Planks, moving guns.

A wrought-iron plate 3′ × 8″ × ¾″ is used to facilitate cutting the muzzles of guns, 35 tons and upwards, when being parbuckled on wood skids. Plate, moving guns, § 3202.

Picket posts (Mark II) are of ash shod with an iron point and hooped at the head. For garrison service they are 5′, 6′, or 8′ long; those 6″ in diameter and over 5′ in length have a hole in the head to take the guide rod of the pile driver. Mark I are of oak, in other respects the same as II, 8′ picket posts, Mark III, are of pitch pine. Posts, picket, L. of C., § 2634.

The following are the ground rollers in the service:— Rollers ground.

| | | |
|---|---|---|
| 8′ × 8″ | diameter | steel |
| 8′ × 12″ | „ | oak, iron-bound. |
| 7′ × 12″ | „ | „ „ |
| 6′ × 10″ | „ | elm |
| 6′ × 6″ | „ | „ |
| 4′ × 10″ | „ | „ |
| 3′ × 7″ | „ | „ |
| 3′ × 6″ | „ | „ |
| 3′ × 5″ | „ | „ and sabicu. |
| 2¾′ × 12″ | „ | oak, iron-bound. |

| | | | |
|---|---|---|---|
| $2\frac{1}{2}'$ | × | 5″ | diameter, elm and sabicu. |
| 2′ | × | 8″ | „ sabicu. |
| 2′ | × | 5″ | „ „ |
| 20″ | × | 5″ | „ „ |
| 14″ | × | 5″ | „ „ |

Ropes.

Parbuckling ropes are fitted with an iron hook at each end. The following are the ropes in the service :—

| | | | |
|---|---|---|---|
| 18 | fathoms | 6″ | white hawser. |
| | | 4″ | tarred „ |
| 15 | „ | 4″ | tarred „ |
| 12 | „ | $3\frac{1}{2}$″ | „ „ |

Preventor ropes are of $3\frac{1}{2}$″ tarred rope, 30′ long for iron platforms and of 3″ tarred rope 33′ long for wood platforms. Each rope is fitted with a hook at one end.

Scotches. L. of C., § 3171.

Wood scotches are of three sizes, large 12″ × 6″ × 6″, medium 9″ × 5″ × 4″, and small 6″ × 4″ × $2\frac{1}{2}$″ ; they are made of elm.

A scotch with handle is used in parbuckling 35 ton guns and upwards : it is the ordinary large scotch, but provided with a handle 6′ long, which screws into a nut in the scotch.

Selvagees. L. of C., § 3259.

A selvagee is formed of rope yarns laid in circles, and marled together. The sizes of those for slinging projectiles when loading are as follows :—

| | No. of strands. | Length in the double. |
|---|---|---|
| 9″ .. .. | 22 | 37″ |
| 10″ .. .. | 22 | 41″ |
| 11″ .. .. | 26 | 43″ |
| 12″ 25 tons .. | 26 | 46″ |
| 12″ 35 „ .. | — | 42″ |
| 12·5″ .. .. | — | 45″ |

Ordinary selvagees are 4′ and 4′ 6″, and are issued in equal proportions.

Shackle, iron. L. or C., § 3203.

A wrought iron shackle is used in lifting 35 and 38 ton guns ; it is secured round the cascable by two pins with keys, and is provided with a loop for lifting. Weight $2\frac{1}{4}$ cwts.

Side arms.

Side arms for rifled guns for garrison service are as follows :—

| Nature. | Sponge. | | Rammer. | | Wadhook. | |
|---|---|---|---|---|---|---|
| | Weight. | Total length. | Weight. | Total length. | Weight. | Total length. |
| | lbs. | ft. in. | lbs. | ft. in. | lbs. | ft. in. |
| B.L., *12″ ... ... ... | 66 | 29 10½ | 30 | — | — | — |
| B.L. 6″ { bore ... ... ... | 12¾ | — | — | — | — | — |
| B.L. 6″ { chamber ... ... | 11 | — | 10 | — | — | — |
| R.B.L., 7″ ... ... ... | 12 | — | 10 | — | — | — |
| ,, 40-pr. ... ... ... | 9½ | — | 7½ | — | — | — |
| ,, 20-pr. ... ... ... | — | — | — | — | — | — |
| R.M.L., *16″ ... ... ... | 131 | [1]27 1½ | 93 | 21 10½ | 74 | [1]26 1½ |
| ,, 12·5 ... ... ... | 43 | 17 9¾ | Mark I, 47<br>Mark II, 42½<br>Mark III, 53½ | — | 24 | 17 2 |
| ,, 12″, 35 tons ... ... | 29 | 14 9½ | 48½ | — | 18 | 14 2 |
| ,, 12″, 25 tons ... { | Mark I, 37½<br>Mark II, 30 | 13 4 | 46½ | — | 17 | 12 9 |
| ,, 11″ ... ... ... | 28½ | 13 4 | 39½ | — | 17 | 12 9 |
| ,, 10″ ... ... ... | 22 | 13 4 | 30 | — | 17 | 12 9 |
| ,, 9″ ... ... ... | 16 | 11 9½ | 16 | — | 11½ | 11 0 |
| ,, *9″ Moncrieff... ... | 20½ | [1]— | 20 5/16 | [1]— | 12 6/16 | [1]— |
| ,, 8″ ... ... ... | 11 12/16 | — | 13 2/16 | — | 17 12/16 | — |
| ,, 8″ howitzer, 46 cwt. | 9 | 5 3½ | 9¼ | 5 0¾ | 5½ | 5 3½ |
| ,, 7″, 7 tons ... ... | 12 | 11 9½ | 13 | — | 11½ | 11 0 |
| ,, 7″ Moncrieff... ... | 22½ | [2]— | 20½ | [4]— | — | — |
| ,, 7″, 6½ tons, 6′ parapet | 22 | [3]12 11 | 22¾ | [4]11 0¾ | 11½ | 0 8½ |
| ,, 7″, 6½ tons ... ... | 12 | 11 9½ | 13 | — | 11½ | 11 0 |
| ,, 80-pr. ... ... ... | 9 | 10 8¼ | 7¾ | — | 7 | 10 0 |
| ,, 64″ ... ... { [3] { | A and B, 8¾<br>C and D, 7¾<br>58 cwt., 8¼ | — | 7¼ | — | 11½ | 11 0 |
| ,, 64″ ... ... { [3] { | A and B, 14½<br>C and D, 14¼<br>58 cwt., 15 | — | 12 | — | — | — |
| ,, 40-pr. ... ... ... | 8½ | 9 11½ | 7½ | 9 6½ | 8 | 9 11½ |
| S.B., B.L., 32-pr. ... ... | — | 10 5 | — | 3 7 | — | — |

* End staves.
B.L., 12″, weight 25 lbs., length.
R.M.L., 16″, weight 41 lbs., length.
R.M.L., 9″, weight 5 1/16 lbs., length.

[1] For end stave.
[2] Rope stave.
[3] Wire rope stave.
[4] Jointed.

The sponge head is of elm, covered with fleecy hosiery, glued on for M.L. guns, and B.L. guns. For R.B.L. guns the head is covered with a coating of woven hemp and canvas tied on. For the 7″ R.M.L. and upwards, the total diameter of the head is ½″ less than the bore of the gun, for the 80-pr. and lower natures the head is of the same diameter as the bore. The head is secured on the wood stave with a copper pin and has the nature of gun for which it is intended marked upon it. The heads of 64-pr. and 80-pr. sponges are also marked with the letters denoting the form of chamber for which they are suitable. The wood staves are of ash; they are made of such a length for the R.M.L. guns, that when the sponge is home to the bottom of the bore, the end of the stave shall project 15″ from the muzzle. The R.B.L. sponge staves are marked with a copper ring to show when they are home in the powder chamber. Two natures of sponges are issued for B.L. guns to be used respectively for the bores and for the powder chamber. The only difference being that the heads of the chamber sponges are of slightly increased diameter to suit the chambers of the guns for which they are respectively intended.

The staves of the 16″ and of the bore sponge for B.L. guns, are lengthened by end staves, as described for the piasaba brushes. The sponge for the 9″ Moncrieff is also fitted with an end stave, connected by a screw joint in a similar manner.

For the R.M.L. guns the rammer head is of elm, cupped to allow

of a wad being rammed home and recessed to protect the fuze; it is bound with copper, in the 9″ R.M.L. and upwards with two bands, and in the lower natures with one. In the former natures it is secured on the stave by a copper rivet, in the latter it was secured by a wood pin, but since March 1886, all rammer heads have been secured by copper rivets. The rammer staves are of ash or rock elm, and are made of such length that the total length of the rammer is somewhat less than the total length of the sponge. The rammer staves of R.M.L. guns are marked by the insertion of a metal screw with rounded head at the point which meets the muzzle of the gun when a service charge and common shell is rammed home. The head of the screw only projects sufficiently to be felt, the lower part being countersunk. This screw is to be inserted after issue.

L. of C., § 2920.

The 10″, 11″, 12″, and 12·5″ rammer staves are each fitted with an iron band with loops, to which are attached guide ropes for use in loading; the hooks of the latter, Mark II, have spring clips to prevent their becoming detached. The ropes are 2″ white, and of such a length as to reach the front of the carriage bracket when the rammer is placed over the head of the projectile and entered 3″ in the bore of the gun.

The jointed rammers for under cover loading, are similar to those for siege guns.

The heads for the rammers, for the R.B.L. and B.L. guns are flat ended. The 40-pr. R.B.L. rammer head is of ash in one piece with its stave.

The wadhook consists of a wrought iron socket with worm head riveted on to a stave of ash.

Skids.

The following are the skids in the service:—

| | | | | |
|---|---|---|---|---|
| 20′ | × | 15″ | square | fir |
| 20′ | × | 9″ | „ | „ |
| 14′ | × | 12″ | „ | „ |
| 14′ | × | 8″ | „ | „ |
| 6′ | × | 12″ | „ | „ |
| 4′ | × | 12″ | „ | „ |
| 3′ | × | 6″ | „ | oak |
| 3′ | × | 4″ | „ | „ |
| 3′ | × | 3″ | „ | „ |
| 5′ | × | 6″ × 5″ | | „ |
| 3′ | × | 9″ × 6″ | | „ |
| 3′ | × | 6″ × 3″ | | „ |

*Dismounting.*

| | | | | |
|---|---|---|---|---|
| 14′ | × | 8″ square, fir beveled with grummets. | | |
| 11½′ | × | 15″ × 20″, | oak bolted together, | 35 and 38 ton guns. |
| 11½′ | × | 10″ × 20″ | „ | 11″ or 12″ 25 tons. |
| 10′ | × | 9″ × 15″ | „ | 10″ guns. |
| 10′ | × | 8″ × 13″ | „ | 9″ „ |

Spanners, hydraulic buffer.

Spanners for use with hydraulic buffers, have been placed for purposes of nomenclature in a numbered series.

The following are the spanners for garrison service:—

| No. | Service. |
|---|---|
| No. 2 | Gland, platform, R.M.L. 12·5″, 12″ 25 tons to 7″ and medium Nos. 11, 12, and 19. |
| „ 3 | Gland, medium platform, No. 9. |
| „ 4 | Gland, medium carriages Nos. 4, 5 and 6. |
| „ 5 | Gland, 12″ 35 tons and small port 12·5″ 7′ recoil. |
| „ 6 | Plug and cock. |
| „ 21 | With tommy, gland, carriage, garrison, R.M.L. 12·5″, steel. |
| „ 22* | Cap, B.L. 12″ garrison, steel. |
| „ 23 | With plate, gland outer, B.L. 12″ garrison, steel. |
| „ 24 | Gland inner, B.L. 12″ garrison, steel. |
| „ 25 | Nut, piston rod, B.L. 12″ garrison, steel. |
| „ 26 | Union, pipe connecting and plug metal filling hole B.L. 12″ garrison, steel. |
| „ 27 | Coupling and nut joint, pipe connecting, B.L. 12″ garrison, steel. |
| Special | R.M.L. 11″ or 12″. |

No. 2 is a double ended spanner, one end being suitable for 12″ of 35 tons, and 12·5″ platform, and the other for the lower natures. Weight 11¼ lbs.

No. 3 is a conversion of No. 2 into a single ended spanner to suit medium platform No. 9.

Nos. 4 and 5 are double ended spanners of the ordinary type.

No. 6 a double ended spanner; one end being formed to fit the plug of the filling hole, and the other the run-off cock.

No. 21 is a bent spanner, the jaws being at right angles to the axis. There are two holes for the tommy at the end.

A socket spanner with tommy is used for adjusting the chains of the running back gear on the 38 ton platform. Spanner, tightening chain, platform

These spanners are of the ordinary pattern, and are made of malleable cast-iron. They are of the following sizes:— Spanners, ordnance artificers.

Double-ended: 1½″ and 1⅜″; 1¼″ „ 1⅛″; 1″ „ ⅞″; ¾″ „ ⅝″; ½″ „ ⅜″; 1⅛″

Socket: 1″; ⅞″; ¾″; ⅝″; ½″

Mark I loading stage, for use with guns mounted *en barbette* in "C" and "D" pivot emplacements with sunken ways, consists of a boarded platform with steps at each end, mounted on two pairs of Stage, loading L. of C., § 3139. § 4288.

* Spanners, hydraulic buffer, Nos. 22 to 27.

No. 22 is a single ended socket spanner, length 4′ 0·375″. No 23 a single ended with two nibs, 3′ 4·125″. No. 24 single ended 3′·5″. No. 25 single end 2′ 6·875″. No. 26 single end 2′ 6·125″. No. 27 is a double ended spanner.

cast-iron trucks, flanged to run on rails with a 2′ 10″ gauge. Each pair (front and rear) are attached by flanges to a narrow wrought-iron plate, which is attached to the stage by a pivot bolt, to allow of the trucks adjusting themselves to the curve of the rails.

Height (top of rails to top of stage) 3′ 6¼″.
Size, 5′ long by 3′ 8″ wide.
Weight, 5 cwts. 3 qrs. 10 lbs. Tonnage, 2·244 tons.

§ 4288. Mark II stage is similar to Mark I, but is mounted upon a pair of bogies, each fitted with four single flanged trucks.

Distance from centre to centre of trucks, 2′ 10″.
Height to top of stage from top of rails, 3′ 6⅜″.
Size of stage, 5′ × 3′ 8¼″.
Weight, 7 cwts.
Tonnage, 2·298 tons.

§ 4930. When found desirable to facilitate loading, the height of the above stage will be increased 3″ by the addition of a wooden "flat."

The flat is 1′ 10″ wide and 3″ thick, and extends along the whole length of the top inner edge of the stage.

Tackles, loading, §§ 33603, 907. Loading tackles are used for lifting the projectiles in loading R.M.L. guns 9″ and upwards.

For guns mounted behind shields the upper block of the tackle has either a shackle or a large hook, by which it may be slung or hooked to the loading bar, or to the mantlet bar, when a loading bar is not applied.

The lower block is hooked to the selvagee round the projectile; the running end of the fall being led through one of the snatch blocks on the front of the platform, except in the case of 9″ guns.

When the gun is mounted *en barbette*, the upper block has a hook, and is hooked to the muzzle derrick, and the fall is led as before, except in the case of emplacements having sunken ways for loading stages, when the fall is led through an 8″ Bothway block, hooked to a permanent eye let into the wall of the covered way.

When guns are mounted in emplacements having sunken ways, the rammer ropes are led through snatch blocks hooked into eyes on the muzzle derricks.

In the tackles first issued the blocks were of malleable cast-iron galvanized, with iron sheaves. These blocks will be superseded, when the present store is expended, by wrought-iron blocks with phosphor bronze sheaves.

The blocks of each description have been placed in a numbered series, and are as follows:—

| | |
|---|---|
| No. 1, Mark I, „ II | With hook for loading bar, 2½″ rope, 6″ treble. |
| „ 2 | With shackle, 2½″ rope, 6″ treble. |
| „ 3 | With hook, 2½″ rope, 7″ treble. |
| „ 4, Mark I, „ II | With hook, 2½″ rope, 7″ double. |
| „ 5 | With shackle, 2″ rope, 6″ double. |

| | |
|---|---|
| No. 6 | With hook, 2″ rope, 6″ single. |
| „ 7 | With hook, 2″ rope, 7″ double. |
| „ 8 | With hook, muzzle derrick, 2″ rope, 4 snatch. |

No. 1 block, Mark II, differs from Mark I in having a longer shackle. It supersedes Mark I.

No. 4, Mark II, differs from Mark I in having no loop with thimble at the top, and a bollard pin instead of a cheese headed sheave pin for the rope. The above blocks are used with 12·5″ guns in the following works:—

| | |
|---|---|
| Hurst Castle. | Garrison Point. |
| Coalhouse. | Landguard. |
| Cliffe. | Malta { Ricasoli. |
| Shornmead. | Malta { Delimara. |

Blocks Nos. 2 and 4, Mark I, are used for guns above 10″, mounted in casemates and covered emplacements.

Blocks Nos. 3 and 4, Mark I, are used for guns above 10″ fitted with muzzle derricks and mounted *en barbette.*

Blocks Nos. 5 and 6 are used for 9″ and 10″ guns, mounted in casemates and covered emplacements.

Blocks Nos. 6 and 7 are used for 9″ and 10″ guns, fitted with muzzle derricks mounted *en barbette.*

Block No. 8. Two of these blocks are hooked to the eyes on the derricks of guns mounted in emplacements with sunken ways, and the guide ropes of the rammer passed through them.

Tackle for slinging side arms of 38 ton guns in casemates consists, for either sponge or rammer, of a piece of 1½″ white rope, 8′ long, with a hook at one end, a ring at the other, and an intermediate ring 2′ from the latter. Tackle for slinging 38 ton side arms. L. of C., § 3542.

A lead ball, weight 4½ lbs., is fixed on the rope just above the hook.

The rope is rove through a 4″ iron snatch block hooked to an eyebolt in the roof of the casemate, on the right side and near the back; and when the side arm is suspended, the rope is hooked to a small eye in the back of its head, and the intermediate ring is slipped over a hook in the right pier 6′ from the ground. § 4016.

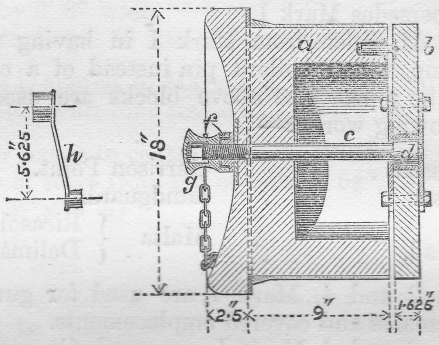
The ends of the staves rest on another piece of rope attached to two eyebolts in the roof of the casemate near the front.

"Magazine" tackle consists of one single and one double block (8″ wood, with lignum vitæ sheaves and copper hooks) and a fall of 2½″ white rope, 14 fathoms long. Tackle, magazine. L. of C., § 2552.

Tampeons for keeping wet out of the muzzles of guns, for R.M.L. guns, are made of elm, the part which enters the bore being covered with collar cloth and strips of leather sewn upon it to enter the grooves. They are made partially hollow for lightness, and fitted on the outer end with a knob of iron as handle, and on the inner end with screw loops for the attachment of a junk wad. The 32-pr. S.B. tampeon with a reduced wad serves for the 64-pr. or 80-pr. R.M.L.; it has a ring instead of a knob. Tampeons.

Mark II tampeons for guns 10″ to 12·5″ are made to correspond with the splay given to the grooves, and the bell form of the mouth of the bore. Mark I have been converted to Mark II.

Fig. 101.




§ 4121. The expanding tampeon for the R.M.L. 16″, Fig. 101, consists of two parts, viz.:—

The tampeon proper (*a*).
The clamp (*b*).

The tampeon (*a*) is of the ordinary description; the cylindrical part is covered with collar cloth, and the shoulder of the head is faced with leather.

A spindle (*c*) passing through the tampeon (*a*) is attached to a cam (*d*); the clamp (*b*) (which is in halves) is forced outwards into the bore by turning the cam with the key (*h*), the other end of the key is then used to set up the nut (*f*), thus pressing the tampeon hard against the face of the muzzle. A cap (*g*), which is screwed on the end of the spindle, is used to cover it, and the nut after the tampeon is secured.

Weight, 60 lbs.
Tonnage, 0·075 tons.

Tampeons for R.B.L. guns are solid, and have neither strips nor screw loops; they have a rope becket instead of a handle. The
§ 4932 muzzle tampeon R.B.L. 7″, when used for Moncrieff mountings, has the head reduced about an inch in thickness.

§ 4097. The tampeons for the 32-pr. S.B., B.L. are similar, the breech
§ 4423. tampeon has three strips of leather, 4″ wide fixed at intervals along it, to suit the breech of the gun.

§ 5086. The L.S. expanding tampeons for B.L. guns are similar to the expanding tampeon for the R.M.L. 16″ gun, except that all the fittings are of gunmetal, while in the 16″ tampeon they are of wrought-iron. Two keys of malleable cast-iron similar to that shown in Fig. 101, are supplied for use with these tampeons. Key, tampeon, B.L. large, for 8″ and upwards, and key, tampeon, B.L. small, for 4″ to 6″.

Sponge tanks are of iron, galvanized, with hooks for attachment to the platform; they are special to each nature, 64-pr. to 12″. Sponge tanks.

The trestle consists of two triangular sides, connected at the base by two cross pieces, and at the top by a round bar, on which the rammer stave can rest. It is intended for use in C emplacements, to support the rammer stave in line with the bore of the gun while loading, where moveable loading stages are not provided. Weight 32 lbs. Trestle loading R.M.L. 11″ steel. § 5089.

A steel turnscrew $6\frac{7}{8}$″ long, is issued for fixing or removing the screw pins connecting the chains of the running back gear of 35 and 38 ton platforms. Turnscrews.

A thin wedge of oak, 18″ long, is used as an inclined plane when parbuckling guns of 35 tons and upwards, to facilitate the passage of the gun from one skid to another not quite on the same level. Wedge, oak. L. of C., § 3202.

The forked wrench for medium wood platforms is 1′ 10″ long, with a T handle of wood 1′ $4\frac{3}{4}$″. Wrenches.

The forked wrench for the ground platforms for howitzer beds, is of iron about 2′ long; forked at one end, the arms of the fork being at right angles to the axis of the wrench. The fork is used for tightening the nuts of the bolts, which secure the outer baulks of the platform. The other end is curved and is suitable for raising the pivot flap at the front of the directing bar.

# PART III.--NAVAL CARRIAGES.

## CHAPTER I.—WOOD CARRIAGES AND SLIDES.

Carriages.

Naval wood carriages are "common," "rear chock," and "sliding," and resemble the corresponding natures of garrison carriages in general construction. They are usually made of elm, except the axletrees or blocks, which are of oak, and they are always fitted with capsquares. Their stoolbeds are of elm; quoins of elm, African oak, or sabicu; they are fitted with swing or depression blocks, which can be placed under the stoolbeds for giving great depression to the gun when required. The elevating screw used with them is either the "common cross-handle" or the "ratchet-headed."

The following are the wood carriages for rifled guns, which may be considered as still in the service.

| Nature. | Common. | | Rear chock. | | Sliding. | |
|---|---|---|---|---|---|---|
| | Weight. | Tonnage. | Weight. | Tonnage. | Weight. | Tonnage. |
| | cwts. | tons. | cwts. | tons. | cwts. | tons. |
| R.B.L. 7″ 82 cwt. .... | — | — | 11¾ | 1·425 | 15¾ | 2·013 |
| ,, 40-pr. .... .... | 8¼ | 2·013 | 12 | 1·775 | 14¼ | 2·037 |
| ,, 20-pr. .... .... | — | — | 4¾ | 1·5 | *a* 2¾ | ·35 |
| | | | | | *b* 3 | ·3 |
| R.M.L. 7″ | — | — | — | — | 25 | — |
| 64-pr. 71 cwt. | 9¼ | 2·028 | — | — | 14¼ | 1·9 |
| 64-pr. 64 ,, | 8½ | 2 | — | — | 14 | 1·925 |
| 7-pr. 200 lbs. | — | — | 1 | 0·191 | 1¼ | ·075 |

(*a*) For buffer.
(*b*) For self-acting compressor.

### Common Carriages.

Standing carriages.

The trucks of the standing carriages are of elm, and beneath the axletrees "fighting" blocks are secured, upon which the carriages can stand in the event of the trucks being damaged in action. There are two blocks beneath the rear axletree, one at each side, and one under the front axletree, which is hollowed out to permit any water on the deck flowing under it.

### Rear Chock Carriages.

Rear chock carriages.

Rear chock carriages have trucks and a fighting block in front similar to standing carriages. Holes are made in the brackets of these carriages, bouched with metal, to receive a breeching rope.

## Sliding Carriages.

Sliding carriages, except the 20-pr., have the same width of guide block as land service wooden sliding carriages, so that they can be used on the dwarf or casemate wooden platform; they differ from the latter carriages not only in the height of the brackets, but in having rear as well as front rollers, holes for a breeching rope (except the 64-pr. of 71 cwt.), and in being fitted with the "side plate" compressor. In the 40-pr. and lower natures of sliding carriages the rear rollers run upon cranked axles, and are brought into play by means of iron-pointed levers, a socket to receive the lever being secured upon the inner end of each axle. In the 64-pr. and higher natures the axles of the rear rollers are eccentric, and have sockets for the iron-pointed levers, as before.

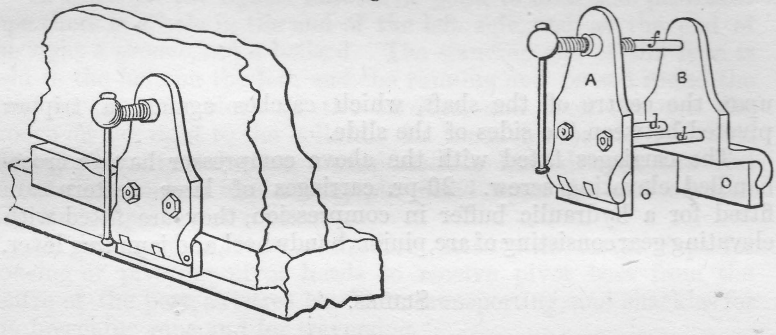
Sliding carriages (*See* R.C.D. photo-lithographs, 80A and 81A).

A metal sheaf is let into the rear block, or in carriages for the 7″ and 68-pr. guns, two sheaves for a preventor rope.

Naval sliding carriages, except the 20-pr., have a hole through the front block to take a transporting axle, in the same manner as the L.S. carriages.

The "side plate" compressor (Fig. 102) consists, on each bracket of the carriage, of two iron plates A, B, with hinged pieces

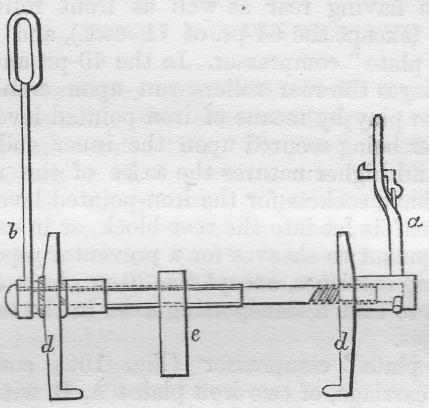
Fig. 102.




O, O, on their ends; they are suspended on iron bolts *d*, *d*, passing through the bracket, so that their lower ends hang down and overlap the side of the slide. The outside plate is bouched in the upper end with a gun-metal nut, through which and the bracket an iron screw *f*, with lever handle, passes, the end of which abuts against the inner plate. By turning the screw the upper ends of the plates may be forced outwards, and the hinged plates caused to grip the sides of the slide.

The self-acting compressor (Fig. 103) for the 20-pr. sliding carriage consists of two clip plates, *d*, *d*, suspended upon the outside of the brackets, a shaft with a left-handed thread cut on one end, and a right-handed thread upon the other, passing through them. Outside each plate on the shaft is placed a nut worked by a lever, that on the left, *a*, being used as an adjusting lever, and that upon the right *b*, as a compressing lever. The adjusting lever being keyed, throwing down the compressing lever forces the nuts against the plates and the latter against the slide. The compressor is made self-acting by a lever *e*, being placed

Fig. 103




upon the centre of the shaft, which catches against a tripper pivoted between the sides of the slide.

§ 2617. The carriages fitted with the above compressor have a cross-handled elevating screw. 20-pr. carriages of later pattern are fitted for a hydraulic buffer in compression, they are fitted with elevating gear consisting of arc, pinion, handwheel, and jamming lever.

## Slides.

The following are the wood slides for rifled guns :—

| Nature. | Length. | Weight. | Tonnage. |
|---|---|---|---|
| | ft. | cwts. | tons. |
| R.B.L. | | | |
| 7″ heavy .. .. .. | 14 | 26½ | 3·20 |
| | 12½ | 25 | 2·85 |
| 40-pr. medium.. .. .. | 12 | 15¼ | 2.75 |
| | 10½ | 14¼ | 1·950 |
| 20-pr. with buffer for self-acting compressor .. bow | — | 4¾ | ·275 |
| 20-pr. with buffer for self-acting compressor .. stern | — | 6 | 1·375 |
| 20-pr. with buffer for self-acting compressor .. bow | — | 3½ | ·25 |
| 20-pr. with buffer for self-acting compressor .. stern | — | 5¾ | 1·375 |
| R.M.L. | | | |
| 64-pr. 64 cwt., heavy .. .. | 12 | 19 | 2·350 |
| | 10½ | 16 | 1·950 |
| 64-pr. 71 cwt., heavy .. .. | 12 | 18 | 2·250 |
| | 10½ | 16 | 1·950 |

A heavy or medium slide consists of two sides of African oak connected by a head block of the same, and two under blocks of sabicu, while down the centre between the sides are placed two planks of sabicu.

Heavy and medium slides. (See R.C.D photo-lithographs, 80A and 81A.)

The sides are parallel, 21″ apart, which, being the same distance as that between the sides of a wooden casemate platform, renders a naval carriage suitable for such a platform. In the heavy slides the sides stand at a slope of $2\frac{1}{2}°$.

The under blocks are shod with metal friction plates to take the bearing upon the racers.

A riband is attached to the outer surface of each side of some slides; this was originally placed there to adapt the slide for the "frame" compressor (now obsolete), and, where it existed has been retained as bringing the sides to a suitable width for the "side plate" compressor.

Heavy slides, except the 64-pr., are fitted with rollers for training upon, the rear rollers having eccentric axles, and being brought into play when required by iron-pointed levers in sockets upon the ends of the axles. When a slide is intended for a traversing slide, a fifth roller, also upon an eccentric axle worked by an iron-pointed lever, is fitted in rear of the front block at the centre of the slide, upon which the latter can be traversed.

In slides for the lighter natures of guns, to take the preventor rope there is a hole in the end of the left side, and at the end of the right a groove and a bollard. The standing end of the rope is held in the hole on the left, and the running end passed round the sheaf in the rear block of the carriage, and back through the groove on the right to the bollard. In the slides for the 7″ whose carriages have two sheaves, a whip block is hinged upon the end of the slide, and an iron sliding pin fitted upon the end of each side for the preventor rope.

All heavy or medium slides are fitted with metal flaps for housing or pivoting, pivot heads to receive pivot bars from the centre of the port, axletree bands for transporting, and shackles for the breeching rope and for traversing.

The 20-pr. slides are either bow or stern for the "Dwarf" and "Avon" class. The bow slide is raised 1″ at the friction plate in front and rear, and has a hole for a fighting bolt in the rear transom. The stern slide is raised 1″ at the friction plate in front and 23″ in rear, by a fixed block, to which is attached in rear a joint, with a flap and catch for pivoting, and two iron loops for training.

The bow slide, as above described, is used both for bow or stern in gunboats of the "Coquette" class.

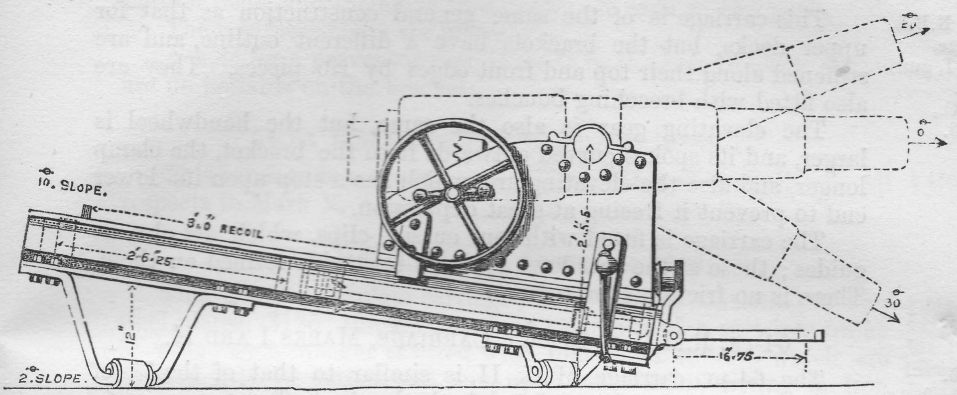
The diameter of the holes in the piston of the hydraulic buffer with which the later pattern of these carriages is fitted is ·477″; contents, 5 quarts; recoil allowed, 2′ $11\frac{1}{4}$″.

## CHAPTER II.—IRON AND STEEL SLIDING CARRIAGES FOR R.B.L. AND R.M.L. GUNS.

The following table gives the weights, &c., of the iron and steel sliding carriages for R.B.L. and R.M.L. guns of R.C.D. manufacture, which may be considered in the service:—

| Nature. | Weight with gear. | Tonnage. | Height to axis of trunnions from slide. |
|---|---|---|---|
| R.B.L. | cwts. | tons. | inches. |
| 20-pr., upper deck .. .. .. .. | 5¼ | 0·289 | 18·25 |
| 20-pr., gun vessel .. .. .. .. | 4 | 0·336 | 18·5 |
| R.M.L. | | | |
| 64-pr., 64 cwt., Mark I .. .. .. | 14½ | 0·887 | 21·00 |
| 64-pr., 64 cwt., Mark II .. .. .. | 14¾ | 0·960 | 23·00 |
| 64-pr., 64 cwt., Mark III .. .. .. | 12½ | 1·039 | 23·00 |
| 64-pr., 64 cwt., Mark IV .. .. .. | 23¼ | 1·298 | — |
| 64-pr., 64 cwt., Mark V .. .. .. | 23¾ | 1·139 | — |
| 64-pr., 64 cwt., Mark VI .. .. .. | 26 | 1·234 | — |
| 7″, 90 cwt. .. .. .. .. .. | 25¼ | 1·575 | 24·50 |
| 7″, 6½ tons .. .. .. .. .. | 34¾ | 1·939 | 31·125 |
| 8″ .. .. .. .. .. .. | 45 | 2·859 | 31·25 |
| 9″, service .. .. .. .. .. | 52 | 3·379 | 31·50 |
| 9″, "Audacious" type, left .. .. .. | — | — | — |
| 9″, "Lord Clyde" type .. .. .. | 52 | 3·379 | — |
| 9″, "Plucky" .. .. .. .. .. | 40¼ | 2·789 | — |
| 9″, "Neptune" .. .. .. .. | 43½ | — | — |
| 9″, "Sultan" type .. .. .. .. | 46¼ | 2·224 | 21·25 |
| 9″, "Shannon" .. .. .. .. | 47¾ | 2·811 | 23·50 |
| 9″, "Prince Albert" .. .. .. .. | 60½ | 3·825 | — |
| 9″, "Scorpion" .. .. .. .. | — | — | — |
| 9″, "Wivern" .. .. .. .. .. | 63 | 4·434 | — |
| 10″, "Sultan" type .. .. .. .. | 86 | 5·585 | 23·00 |
| 10″, "Téméraire" type .. .. .. | 82¼ | 5·585 | — |
| 10″, "Hercules" .. .. .. .. | 86 | 5·585 | — |
| 10″, "Abyssinia" .. .. .. .. | 203¾ | 7·333 | — |
| 10″, "Hecate" type .. .. .. .. | 188½ | 9·118 | — |
| 10″, "Rupert" .. .. .. .. .. | 189¼ | 9·118 | 32·00<br>44·00<br>52·00 |
| 10″, gunboat .. .. .. .. .. | 88 | 4·812 | — |
| 11″ .. .. .. .. .. .. | 89½ | 5·742 | 23·50 |
| 12″, 25 tons, "Belleisle" type .. .. | 83 | 7·607 | — |
| 12″, „ "Glatton" .. .. .. | 206¾ | 10·937 | 34·00<br>45·00<br>51·50 |
| 12″, „ "Monarch" .. .. .. | 209 | 8·233 | 34·00<br>45·50<br>51·50 |
| 12″, 35 tons .. .. .. .. .. | 223¾ | 11·908 | 32·00<br>45·75<br>52·75 |

Fig. 104.




## 20-pr. R.B.L. of 13 or 15 Cwt. Carriage, Mark I, for Upper Decks of Ironclad Ships.

20-pr. R.B.L. of 13 or 15 cwt. carriage, Mark I, for upper decks. (*See* R.C.D. photo-lithograph 91A)

The carriage consists of two brackets connected by a bottom plate and transom.

The brackets are of $\frac{1}{2}$" plate, having each a trunnion plate of angle iron riveted in the trunnion hole; they are connected to the bottom plate by means of angle iron. The transom is of plate riveted to angle iron, and is placed between the brackets immediately under the trunnion holes. The carriage is not fitted with rollers.

The elevating gear is fitted on the right side only, and consists of—

Elevating arc.

Friction roller with spindle and nut.

Pinion with spindle, hand wheel, and jamming lever.

The hand wheel is of wrought iron; a metal bearing is bolted to the bracket to support the spindle; 20° of elevation or 30° depression can be given to the gun.

The carriage has on each bracket a front and rear eye bolt, a capsquare over the trunnion plate, and an iron stop on the inside in front.

It is fitted for the hydraulic buffer by a bracket bolted beneath the bottom plate, and by clips bolted, one to the outside of each bracket, in rear; also, to secure the carriage inboard when required, with a modification of the side plate compressor.

The compressor consists of two side plates, 4" wide, one hung upon the outer side of each bracket towards the front by a single bolt, which passes from the left plate through to the right outside of which plate there is a nut upon it, which can be tightened against the plate as desired, by means of a sliding lever. The plates bear against and catch under a piece of sabicu fixed along each side of the slide, so that as they are tightened together by the nut they fix the carriage to the slide.

## 20-pr. R.B.L. Carriage, Mark I, Gun Vessel.

20-pr. R.B.L. carriage, Mark I, gun vessel. L. of C., § 3088.

This carriage is of the same general construction as that for upper decks, but the brackets have a different outline, and are stiffened along their top and front edges by rib pieces. They are also fitted with breeching bouches.

The elevating gear is also the same, but the handwheel is larger, and its spokes curved outwards from the bracket, the clamp longer, and also the elevating arc, which has a stop upon its lower end to prevent it freeing at great depression.

The carriage is fitted with four outside clips, which act also as guides; those at the rear have eyebolts for tackle formed on them. There is no friction compressor.

## 64-pr. R.M.L. of 64 cwt. Carriage, Marks I and II.

§ 2815. R.C.D. photo-litho, 148.

The 64-pr. carriage, Mark II, is similar to that of the 7″ of 90 cwt., p. 361; but is not fitted for hydraulic buffers.

Elevating gear is fitted on the right side only; the gear has been fitted with a clamping arrangement, similar to that for the 7″ 6½ ton L.S. carriage, described p. 201. It consists of one thread of a screw cut on the metal bearing of the pinion spindle on the outside of the bracket, and a corresponding thread cut on the back of the jamming lever, so that by pressing the latter down (towards the rear) the pinion is prevented from turning. A nut and keep nut is fitted on the spindle to adjust the position of the lever. The compressor has five plates.

Instead of winch gear the carriage is fitted for running in tackle; there is a stud upon the bottom plate, underneath the plate is an iron bracket in which a metal sheave is held, in the rear transom there is a hole for the standing end of the fall to pass through. There is a bollard on each bracket.

Eight carriages of an experimental pattern, distinguished as Mark I, were issued to the "Arab," "Lily," "Sapphire," and "Diamond."

They differ from those of Mark II principally in being 2″ less in height, which gives less space for the compressor gear and for the gun at extreme elevation. The pitch of the screw of the elevating gear is also coarser.

## 64-pr. R.M.L. of 64 cwt. Carriage, Mark III.

64-pr. R.M.L. carriage. Mark III. L. of C., § 3090. R.C.D. photo-lithograph, 149.

This carriage is of the same general construction as the preceding, but shorter.

The brackets and transoms are of $\frac{5}{16}$″ steel plate, the former stiffened by a narrow rib piece of steel along the upper edge, and they are attached to the bottom plate by steel angle bars.

In consequence of the shortness of the brackets, the elevating arc is placed behind the driving pinion, and consequently the teeth are cut on the front of the arc, and the friction roller placed in rear of it. The rear rollers are placed upon a shaft within the rear transom, made in two parts united by a coupling and fitted for lever sockets outside the brackets, the sockets being in continuation of the shaft. A stop is attached to the coupling.

The fittings for the running in tackle are placed beneath the bottom plate, and the angle iron guides are each in two parts.

The compressor has six plates.

A hole for a preventor rope is made in the rear transom. There are no bollards on the brackets.

### 64-PR. R.M.L., 64 CWT. CARRIAGE, MARK IV.

This carriage is a conversion of Mark III, and is similar in all respects to Mark V. § 4192.

### 64-PR. R.M.L. 64 CWT. CARRIAGE, MARK V.

This is a double plate carriage; each bracket consisting of two steel plates, ·3125″ thick, riveted on each side of a cast-iron frame 3″ wide; each bracket is fitted with four steel rollers, which are permanently in action, and run upon steel axles, resting in iron eccentric bearings. § 4192. Fig. 105, R.C.D. photo-lithograph 149A.

The carriage is fitted with a hydraulic buffer, the piston rod of which is in tension during recoil. The front end of the piston rod is connected with the front of the slide. The buffer cylinder is supported in two collars of metal, N, O, Fig. 105, underneath the bottom plate, in such a manner that the carriage can slide a short distance along it when run back for housing, the attachment between the buffer and carriage being by a hinged joint. A wrought-iron trunnion ring with trunnions is shrunk on the buffer; each trunnion is connected by two jointed bars, P, to a steel plate fixed underneath the bottom plate of the carriage, guide bars T on the slide prevent the joints coming into play during recoil; but for housing the gun allows the bars to double together and the carriage to slip backwards; the buffer remaining stationary. The distance thus gained is 5″. Spiral springs, S, on the carriage start the joints into action. Two india-rubber rings are placed on the piston rod between the collar nut and the front of the slide to act as a buffer in running out. The diameter of the holes in the piston is ·38″, working contents of buffer $6\frac{3}{4}$ quarts.

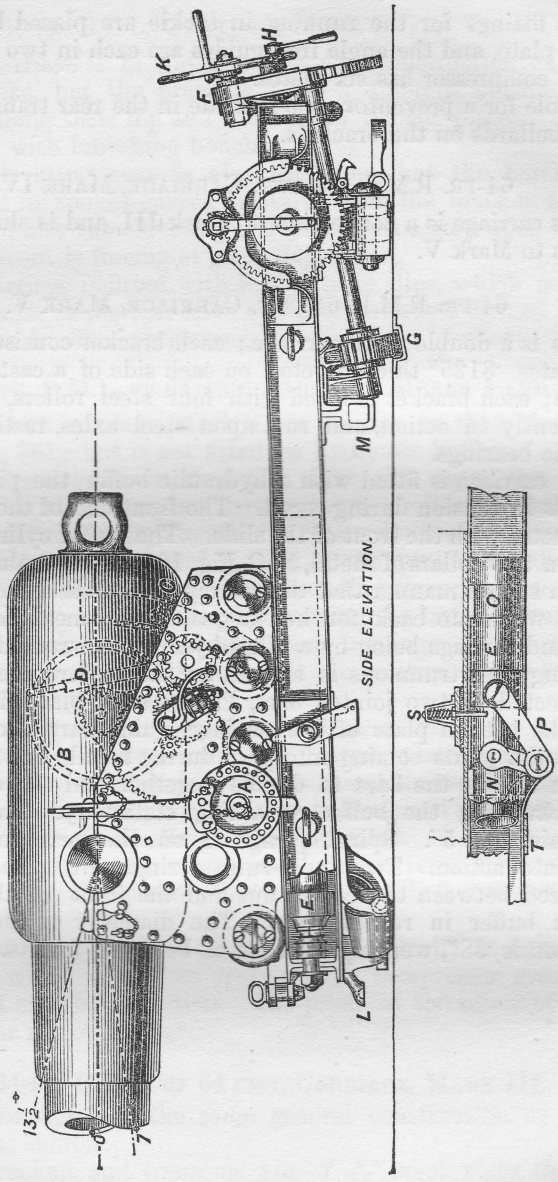



Fig. 105.

There are four plates in the E.O.C. compressor A, two at each side of the hydraulic buffer. The nuts for the rocking levers are on a single shaft with right and left handed screw, which passes right across the carriage from one side to the other, and rests in metal bearings in the brackets. It is secured by a washer and nut on the outside of the right bracket; on the outside of the left bracket fits the compressor lever, which can turn freely round the shaft; on the outside of the lever a wrought-iron disc fits on an octagon on the shaft, and is secured by a washer and nut. The disc affords a means of adjusting the lever, it has a series of holes round its edge to any of which the lever can be secured by a French key.

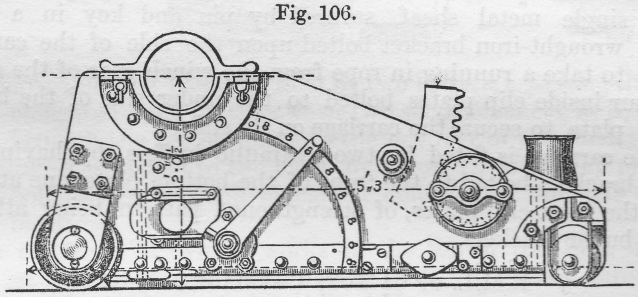
The elevating gear which is fitted on the right side only consists of a train of spur wheels and pinions conveying the power from the handwheel B to the elevating arc. The arc is graduated on the outside and back, and a pointer C is fixed to a bracket on the carriage. The clamping arrangement is similar to that in Marks II and III carriages, but the gear is tightened by forcing the lever towards the front. A gunmetal guide is used instead of a friction roller to keep the arc in gear with the elevating pinion.

### 64-PR. R.M.L. 64-CWT. CARRIAGE. MARK VI.

This is a conversion of Mark II carriage and is generally similar to Mark V. The slip gained for housing is 4″, the diameter of the holes in the piston of the hydraulic buffer is ·414″, the working contents 7¾ qts.

### 7″ R.M.L. OF 90 CWT. CARRIAGE. MARK I.

Fig. 106.



The carriage is formed of two brackets, two transoms, and a bottom plate, and is fitted with front and rear metal rollers.

7″ R.M.L. of 90 cwt. carriage. Mark I. (*See* R.C.D. photo-lithograph, 145). L. of C., § 2668.

The brackets each consist of a single ¾″ plate with a piece of angle iron riveted along the lower edge on the outer side. A forged trunnion plate is riveted on the outer side of the bracket round the trunnion hole to give sufficient bearing for the trunnion of the gun; a metal bearing plate is attached by screws in the trunnion hole, and an iron capsquare fitted over it.

The transoms are formed by riveting ⅝″ plate to angle iron frames, the front transom having also a piece of angle iron riveted along the lower edge in front.

The bottom plate is ¾″ thick; it is slotted for compressor plates and has angle iron guides riveted underneath, the ends of which are bent round to form stops.

The brackets stand upon the bottom plate, projecting beyond it in front and rear in order to receive the rollers; the transoms stand between the brackets along the front and rear of the bottom plate; all the parts are riveted together. The axles of the front rollers are supported in small flanges bolted to the sides of the carriage, in which they rest in metal bearings secured by screws; they are put in from the outside and secured by keys. The axles of the rear rollers are eccentric, and connected by a bent bar with holes in it to take the iron-pointed levers; they rest in similar flanges to the front rollers and in the sides of the carriage, but without metal bearings. To remove the rear rollers or the connecting bar, it is necessary to take off the flanges supporting the

axles. Stops are attached to the rear transom to prevent the rear rollers coming into action during the recoil of the carriage.

The carriage is fitted with the capstan head elevating gear on both sides, similar to that for L.S., but the friction roller spindle is secured by a hexagonal nut and pin. A metal bearing is bolted upon the outside of each bracket for the spindle of the pinion.

The compressor used with the carriage is the Elswick compressor, similar to the L.S. for double plate carriages, metal bearings for the shafts being bolted to the outside of the brackets.

The carriage has also the following fittings, namely:—

A loop riveted in front at each side upon the bottom plate.

An eyebolt on the centre of the front transom.

A hole in each bracket, with metal bouche, to take the breeching rope.

A bollard upon each bracket in rear for a check rope.

A single metal sheaf, secured by pin and key in a small wrought-iron bracket bolted upon the side of the carriage, to take a running in rope from the winch gear of the slide.

Four inside clip plates bolted to the under side of the bottom plate, to secure the carriage on its slide.

The carriage is fitted for two hydraulic buffers, by having two buffer brackets bolted to the front of the bottom plate, one at each side; the front clip plates, of strengthened pattern being attached to the buffer brackets.

### 7″ R.M.L. of 6½ Tons Carriage. Mark I.

7″ R.M.L. of 6½ tons carriage, Mark I, (*See* R.C.D. photo-lithograph, 81B.

This carriage is the same as the land service carriage for the 7″ of 7 tons, with the following additional fitments, namely:—

A bollard upon the rear of each bracket.

A metal sheaf in an iron bracket upon each side.

A loop upon the front of the transom.

An outside clip upon each side in rear, to hold the carriage down upon the slide, in addition to which the inside clip in front is used if the slide is fitted as a traversing one.

Sockets attached to the bottom plate to admit of the use of metal roller handspikes for running up if required.

For naval service the 7″ carriage is always fitted with the Elswick compressor.

Since September 1882, the compressor plates have been made of steel.

Certain of these carriages have been fitted with spur wheel elevating gear similar to that for the 9″, Fig. 108, p. 364.

### 8″ R.M.L. of 9 Tons Carriage. Mark. I.

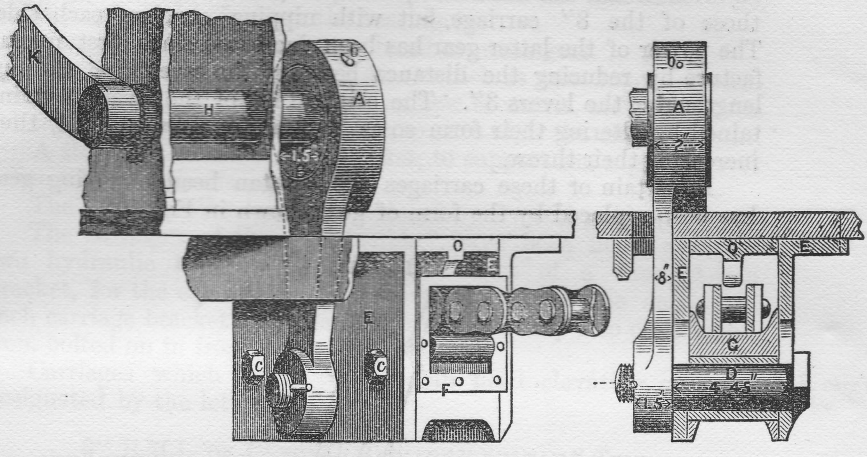
8″ R.M.L. of 9 tons carriage. (R.C.D. photo-lithograph. 147, 147A.)

This carriage is similar to the preceding, and like it has always the Elswick compressor, but is not fitted for winch gear with bollards and sheaves on the brackets, and in it the socket brackets for roller handspikes are discontinued.

Instead of winch gear it is fitted with nipping gear for attaching the carriage to a revolving endless chain on the slide, by which it can be run in or out.

The gear, Fig. 107, consists of the following parts, viz.:—

Fig. 107.




A moveable iron block, C, held by two bolts, *c*, *c*, passing through elongated holes in it, between two small brackets, E, E, bolted beneath the bottom plate to the left rear of the carriage.

A link, A, attached to the block by a bolt D, with keep pin, the bolt passing through elongated holes in the brackets of the block.

An eccentric, B, which works in the top of the link, and is secured in it by a screw *b*; the shaft, H, passes through a metal bearing in the left side of the carriage, and has a bent lever, K, by which it is worked, secured upon its outer end by a keep pin.

A stirrup, F, attached to the rear of the block by screws.

A sprocket plate, O, attached to the bottom of the carriage between the brackets of the block.

The endless chain of the slide passes through the stirrup, over the block, and under the sprocket plate, consequently, when the lever of the eccentric is moved to the rear and the block so raised, the chain is jammed by the latter against the teeth of the sprocket plate, which catch in it and fix the carriage to the chain. On the lever, however, being released, the block falls by its own weight, its stirrup carrying the chain down with it, and consequently freeing the carriage from the latter.

In certain of these carriages the capstan head elevating gear has been replaced by a train of spur wheels and pinions, worked by a handwheel. The new gear is similar to that for the 9″ carriage p. 364; but the graduation of the arc is confined to the side and does not extend to the back edge. The lever of the nipping gear is bent to clear the altered elevating gear. Carriages which retain the capstan head elevating gear are designated by the letters O.P. § 4042.

### 9″ R.M.L. of 12 Tons Carriage. Service.

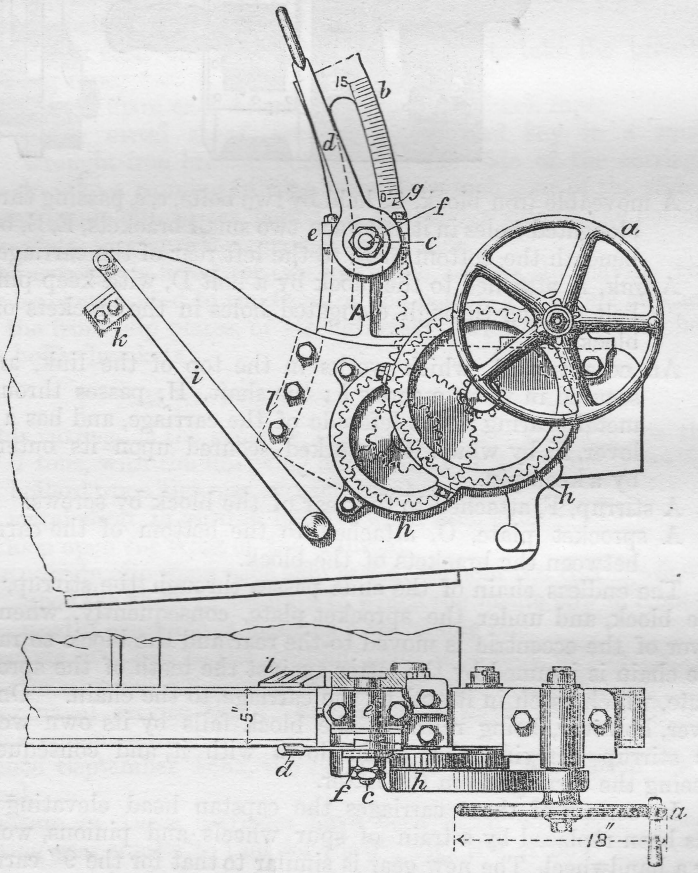
9″ R.M.L. of 12 tons carriage, service. (R.C.D. photo-lithograph, 146.)

This is the same as the 9″ carriage for land service, fitted with the Elswick compressor, the capstan head elevating gear, and with the axles of the rear rollers, united by a connecting bar. In

addition it has the fitments special to the sea service, similar to those of the 8″ carriage, but with nipping gear on each side. The power of the latter gear has been increased since first manufacture by reducing the distance between the eccentrics, and by lengthening the levers 3″. The original lift of the levers is maintained by altering their form so as to clear the capstan head, thus increasing their throw.

In certain of these carriages the capstan head elevating gear has been replaced by the form of gear shown in Fig. 108.

Fig. 108.




The gear consists of a train of spur wheels and pinions transmitting the power applied by the handwheel (*a*) to the teeth of the elevating arc (*b*).

The clamping gear consists of a bolt (*c*) sliding in a slot in the arc (*b*), and brought into action by a jamming lever (*d*), having a thread of a screw at the back, acting against a bearing (*e*) on the top of the bracket, with a similar thread on its face.

Adjusting and lock nuts (*f*) on the end of the bolt (*c*) give any amount of adjustment required.

The elevating arcs (*b*) are graduated on the side and back edge, and a pointer (*g*) is fixed on the bearing (*e*).

Gun-metal covers (*h*, *h*,) are placed over the gear.

The lever (*i*) of the nipping gear, which is now made of steel and straight in form, together with a new eccentric, are substituted for the existing lever and eccentric, so as to clear the elevating gear.

A stop (*k*) is fixed on the bracket, to support the nipping lever when the chain is disengaged.

The friction roller has been replaced by a metal guide (*l*).

The carriages of the "Invincible" have been fitted each for two hydraulic buffers. The fittings consist of a wrought-iron bracket, for the end of the piston rod, bolted on the outside of each carriage bracket near the rear, and a rear clip also of wrought-iron, bolted on in front of the bracket.

Carriages which retain the capstan head elevating gear are designated by the letters O.P. O.P. carriage service.

## 9″ R.M.L. of 12 tons Carriage "Sultan" Type.

§ 3086 R.C.D. photo-litho. 87.

The brackets of this carriage are lower than those of the service type, and the bottom is well shaped so as to lie between the sides of the slide.

The carriage consists of two long low brackets of the double-plate construction with cast-iron frames, $4\frac{1}{2}$″ in width (the plates $\frac{1}{2}$″ thick); the inner plates project considerably beyond the under sides of the frame, and form the sides of the well; to these plates the bottom plate, $\frac{3}{4}$″ thick, is attached by means of angle iron, while the transoms fill in the ends and complete the well.

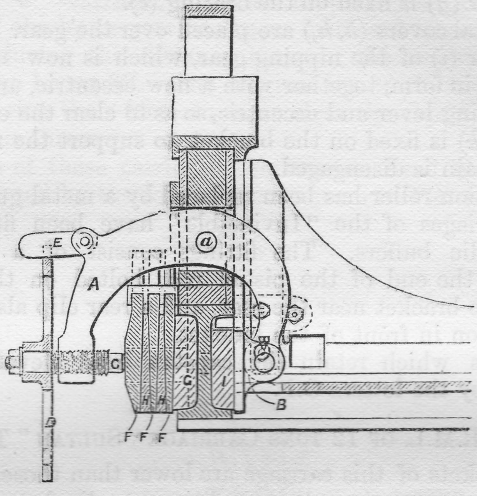
The front and rear rollers are completely hidden in their recesses in the brackets; the eccentric axles of the rear rollers are formed on the same shaft, which is round, bent in the middle, and has socket holes for the iron-pointed levers. The shaft is held in each bracket in sliding pieces held by bolts, one piece sliding in the inner and the other in the outer plates of the bracket, the plates being strengthened by overlapping pieces riveted to them. The end of the shaft rests in a bearing in the outer piece, passing through a slot in the inner piece in which it is secured by a clip with two bolts.

The elevating gear is the "capstan head," a friction collar of gutta-percha being added on the spindle between the side and the capstan head. O. P. Carriage "Sultan."

Spur wheel gear similar to that shown in Fig. 108, has also been fitted to this carriage. Carriages with the capstan head gear are designated as O.P.

The compressor fitted to the carriage is that known as the "bow" compressor, Fig. 109. It comprises on each side a bow or cramp, A, pivoted at the centre by a pin, *a*, secured by a keep screw, in a metal bearing bolted to the outside of the bracket, so that one arm projects inside the carriage through the bracket. To the end of the inner arm a plate, B, is hinged by a pin, secured by a collar and keep pin, while the end of the outer holds an adjusting screw, C, with a wheel, D, secured by a collar and nut by which the screw is worked. The wheel is notched to take a pawl, E, for

Fig. 109.




holding it in any required position, the pawl being secured by a pin, with collar and keep key upon the upper part of the arm; it is fitted with two handles (the front double and the rear single, not shown in Fig.) secured by thumbscrews, by which it is turned, and has a brass arc fixed upon it, graduated in equal intervals numbered from 1 to 17 on the upper half, for guidance in slackening up, and fitted with a set screw, by which the amount of compression last given is marked; on the opposite side of the rim of the wheel is an arrow to show the direction for tightening the compressor.

Two projecting pieces are attached to the side of the carriage to support the compressor plates, which hang upon them in such a position that the centre of each plate comes opposite to the adjusting screw; the plates, F, F, F, are three in number, the outer one being thicker than the other two, which are tapering. When the carriage is mounted on its slide, the tapering plates lie between the side of the slide which is filled in with wood, G, and the compressor bars, H, which are also tapered to correspond, while the thick plate hangs outside the outer bar, the adjusting screw touching it, and the plate upon the inner arm of the cramp bears against the inner side of the slide, which is also filled in with wood, I. By this arrangement, when the screw is tightened by turning to the rear, it jams the plates and bars, together with the side of the slide, between itself and the end of the inner arm, and so, more or less, fixes the carriage to the slide.

The wheels and cramps are marked "right" or "left," according to the side of the carriage to which they belong.

The carriage is fitted with nipping gear on the left side only, only one running-in-and-out chain being used: the brackets for the block of the gear are bolted upon instead of beneath the bottom plate as the chain passes through the well.

An eye-bolt is fitted upon the top of each bracket of the car-

riage in rear, and a buffer block upon each transom, that upon the front transom being iron bound; holding-down clips are also bolted upon the latter transom. The carriage has a securing shackle on each side; and a breeching loop is bolted to the front of each bracket.

In addition to the "Sultan," this type is suitable for the "Nelson," "Northampton," "Cambridge," "Excellent," "Raleigh," and "Shah."

### 9″ R.M.L. of 12 Tons Carriage for "Shannon."

This carriage is generally similar to that of the "Sultan" type, the arrangement of the nipping gear and the outline of the carriage is slightly different to suit the greater slope of the slide. The elevating arcs are longer and admit of 12° elevation.

### 9″ R.M.L. of 12 Tons for "Plucky."

This carriage is generally similar to the 10″ gun boat, but is not fitted with hydraulic buffers, and is fitted with the E.O.C. compressor and with capstan head elevating gear.

### 9″ R.M.L. 12 Tons Turret Carriage for "Scorpion."

These carriages are intended for a double turret; they are right and left and not interchangeable.

The brackets are higher than those of the service pattern; the Elswick compressor is differently arranged, the plates being hung close to the brackets four at each side; the rocking levers are worked by a single shaft, fitted with a handwheel upon its outer end, similar to that for the bow compressor.

The elevating gear is similar to that shown in Fig. 108, p. 364.

The rear rollers run upon an eccentric shaft, and are thrown into gear by a lever with tackle on the end of the shaft outside the outer bracket.

### For "Prince Albert."

This is a single turret carriage and has a handwheel for the elevating gear and a lever for the rear rollers on each side of the carriage; it is fitted for a hydraulic buffer and with a bow compressor.

Working contents of buffer, 11½ gallons.

### For "Wivern."

"Wivern" type. L. of C., § 3555.

The 9″ turret carriages of the "Wivern" type are of the service type, differing only in their gear. They are fitted as right and left.

The compressor acts by rocking levers on each side on the sides of the slide, and is worked by a wheel similar to that used with the bow compressor on the outside of the carriage.

It is also fitted for a hydraulic buffer, which is similar to that for land service, but slightly longer, and for use contains 11½ gallons.

The nipping gear is of the service pattern, but fitted on the outer side only; the lever is special.

The elevating gear, which is similar to that shown in Fig. 108, and rear rollers are worked as above described.

Two india-rubber buffers with metal spindles are secured in a block across the front of the carriage.

### 10″ R.M.L. of 18 Tons Carriage, "Sultan" Type. O.P.

10″ R.M.L. "Sultan" type. (R.C.D. photo-lithographs, 88 and 88A.)

The 10″ carriage is of similar form to the 9″, but has box-shaped transoms which extend considerably below the lower edges of the brackets, and under which the bottom plate is riveted, completing the well.

The eccentric shaft for the rear rollers is formed in two parts connected in the centre of the carriage by a coupling with pins; the axle end of each part runs in a metal bearing secured by screws in the inner bracket plate. Upon the left, the shaft is fitted with a hydraulic jack for throwing the rollers into gear, and upon the right with a capstan head arrangement for the same purpose should the jack be damaged or out of order.

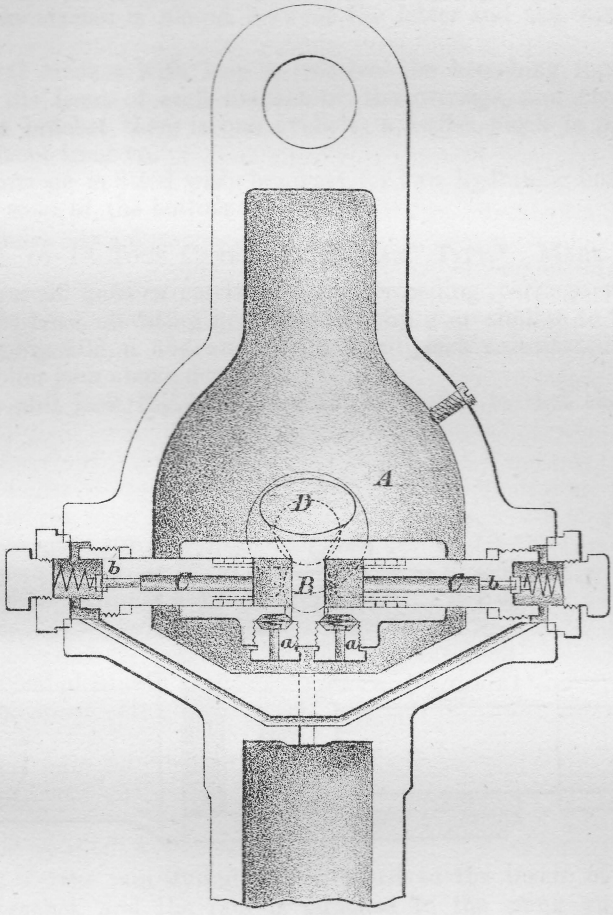
The jack is attached to a crank upon the shaft by a pin which passes through the lower end of the ram and is secured by a key: the crank is fixed to the shaft by means of a feather and slot. The upper end of the jack is attached by the projecting arm of a small iron bracket bolted upon the top of the carriage bracket, passing through an eye in the cap, and being secured by a collar and keep pin. The jack is shown in Plate LV, the reservoir A, is oval in form, opening at one face, the pump B, which lies in it horizontally is double, and can be moved right or left over its pistons C, C, which are held, one in each side of the reservoir, by means of a crank D, at the centre worked in the usual way by a lever outside. In the under part of the pump at each side is an inlet valve *a*, while an outlet valve *b* is placed at the end of each piston, the latter having a passage in it for the water to flow from the pump to the valve, while a passage is formed in the side of the reservoir from the valve to the ram. By this arrangement when the pump is moved to one side pressure is passed to the ram from that side while water is drawn in through the inlet valve at the opposite side, and *vice versâ*. The jack has the usual passage and lever for lowering.

To prevent it being pumped too low, a hole is made at the correct level in the cylinder, and another in the reservoir, and these are connected by a channel outside.

The capstan head arrangement upon the right of the shaft consists of a toothed quadrant attached to the former by a feather and slot, and by a securing screw; above the quadrant upon a spindle in the right bracket of the carriage there is a metal capstan head and spur pinion, in one, secured by collar and key. The pinion gears in the quadrant, so that by working the capstan head with an iron-pointed lever the shaft is turned and the rollers thrown into gear. Above the pinion on a spindle through the bracket of the carriage there is a pawl with handle, by which the pinion can be pawled and the rollers so retained in gear.

# DOUBLE ACTING LIFTING JACK.

## 10 R.M.L. SULTAN TYPE. O.P.




DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 12456.

Nipping gear is fitted on both sides of the carriage; in the end of the nipping lever there is an eye from which a rope is led over a metal sheaf secured by a bolt and pin in a small metal bracket bolted upon the top of the bracket of the carriage.

A stop bolt, which on being dropped into any hole in the capstan head of the elevating gear will hold the latter, is fitted in a metal bracket bolted on the side of the carriage, and a gutta-percha washer is placed between the latter and the capstan head.

A metal bracket with loop to receive the breeching rope is bolted to the front of each bracket of the carriage, and on the side of the bracket there is one eyebolt; a buffer block is fitted upon the front transom.

The carriage is fitted with brackets for two hydraulic buffers under the front of the bottom plate.

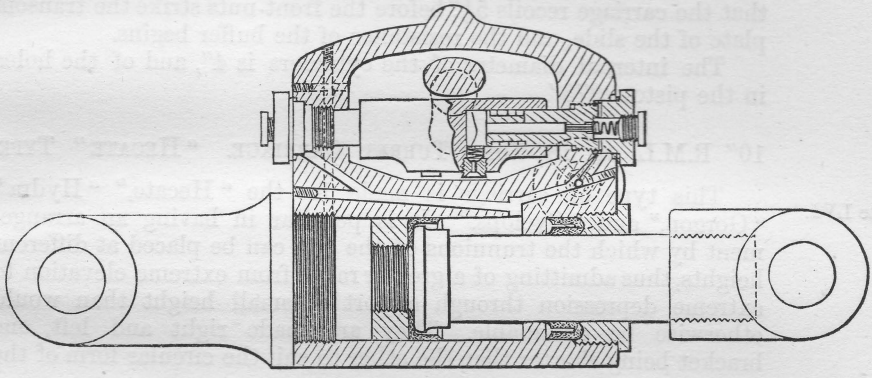
### 10″ R.M.L. of 18 Tons Carriage "Sultan" Type.* Mark II.

R.C.D, photo-litho. 91

The present pattern carriage is the preceding carriage with the capstan head elevating gear replaced by gear similar to that for the 9″, Fig. 108, p. 364, and having a pull jack substituted for the rear roller jack above described.

In the pull jack, Fig. 110, the pump is similar to that shown

Fig. 110.



in Plate LV; the ram cylinder is attached to the inside of the carriage bracket, and the ram is attached to the crank on the eccentric shaft in such a manner that when the ram enters the cylinder the carriage is raised on its rollers. The ram has a cup leather secured on its end by a nut; and where it enters the cylinder has round it a U leather ring kept in its place by a metal screw gland.

### 10″ R.M.L. of 18 Tons Carriage "Temeraire" Type.†

This carriage is similar to that of the "Sultan" type, but differs from it in the brackets for the piston rod of the hydraulic buffers.

* This carriage is also suitable for the "Superb," main deck.

† This carriage is also suitable for the "Superb," upper deck, the "Alexandra," "Nelson," "Northampton," and "Shannon."

### 10″ R.M.L. of 18 Tons Carriage for "Hercules."

This carriage is similar to that of the "Sultan" type, but differs from it in the nipping gear.

### 10″ R.M.L. of 18 Tons Gunboat Carriage.

R.C.D. photo-litho 90. §§ 2024, 3670.

This carriage is similar to the "Sultan" type, with the following exceptions:—

The well is deeper so as to allow of 12° elevation being given to the gun; the rear end of the brackets are shortened by 4″ to allow the gun to be lowered beneath the upper deck into the well; the carriage is not fitted with nipping gear, but has instead, for running back, two metal sheaves attached to the rear transom; a stud is screwed to the bottom plate at each side to prevent the inside compressor plate becoming too much inclined when out of action; the jamming lever of the elevating gear is of the form similar to that used with the capstan head gear; and the carriage is fitted with two hydraulic buffers.

The buffer cylinders lie over the bottom plate of the carriage one inside each bracket, passing through holes in the transoms and being secured by flanged collars bolted to the front and rear transom plates; the ends of the piston rods passing through holes in the front transom of the slide.

The nuts on the piston rods are placed at such a distance apart that the carriage recoils 5½″ before the front nuts strike the transom plate of the slide, and the resistance of the buffer begins.

The internal diameter of the cylinders is 4″, and of the holes in the piston ·275″.

### 10″ R.M.L. of 18 Tons Turret Carriage. "Hecate" Type.

Plate LVI.

This type of carriage is made for the "Hecate," "Hydra" "Gorgon," and "Cyclops." It is peculiar in having an arrangement by which the trunnions of the gun can be placed at different heights, thus admitting of a greater range from extreme elevation to extreme depression through a port of small height than would otherwise be obtainable. They are made right and left, one bracket being shorter than the other to suit the circular form of the turret.

The carriage is composed of two brackets, four transoms, a bottom plate, and a saddle.

The frames of the brackets 6″ in width are formed in two parts, one much larger than the other; the larger is of cast iron and the smaller of wrought iron, the latter lies in the former and receives the saddle which carries the gun. The plates riveted over the frames are 1″ in thickness, the inner one being slotted to admit the saddle into the wrought-iron frame, and the outer one strengthened by a plate riveted at the upper part over the position of the ends of the same frame. The brackets are of different length, that which is the outer when the gun is mounted in the turret being the shorter: they also project a little at the bottom in front beyond the line of the breast.

The three front transoms are low and formed in the usual manner of plate riveted to angle iron; they are riveted to the brackets and bottom plate, the first connects the projecting ends of the brackets, the second is placed to the front of the saddle slots, and the third to the rear of the same. The rear transom is of plate stiffened by two horizontal ribs of angle iron, and connects the rear extremities of the brackets, being bent to suit their different length.

The well of the carriage is shallow, the sides of it are formed by angle iron riveted to the brackets, to which iron the bottom plate is riveted; the latter is slotted at each side for the compressor plates.

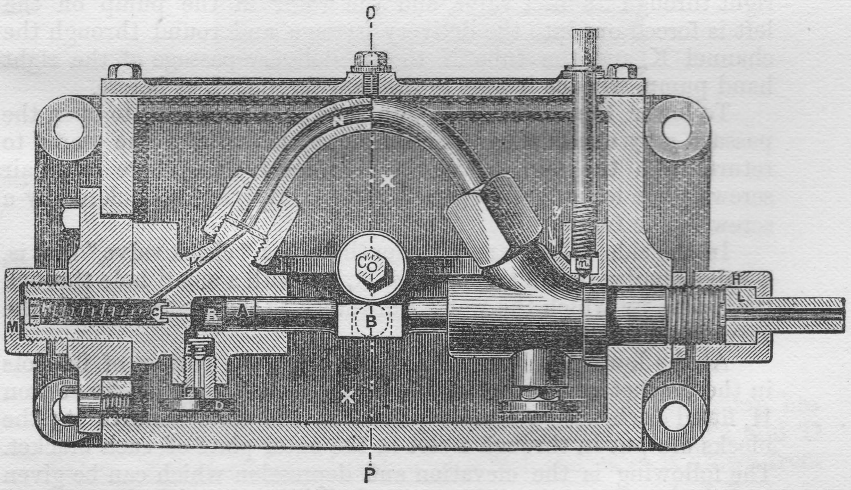
The saddle B, Plate LVI, is semi-circular in elevation to suit the form of the gun, and consists of three blocks, one at each end of cast steel, and one in the centre of wrought iron, united by two plates lying on their sides; the whole is held together by bolts from plate to plate, some passing through the blocks and some not, the latter being collar bolts. The steel blocks have a trunnion hole in each, which is fitted with a phosphor bronze bearing, and with a capsquare, which is formed by a block of wrought iron fitted with a loop handle on the top and secured by four bolts each with two nuts.

It has been approved to increase the diameter of these bolts to 1·375″, and to place a wrought iron washer with indiarubber collar under the nuts. § 3948.

The cylinder with the ram A, for raising and lowering the gun in its saddle passes through the bottom plate immediately beneath the centre block of the saddle, against which the ram when acting takes a bearing; it is held in its position in a metal bracket which is secured by clips to the bottom plate.

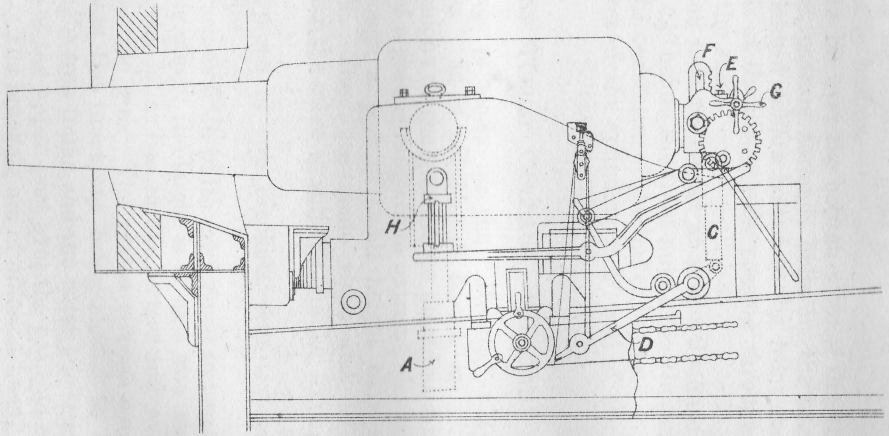
The hydraulic arrangement, Fig. 111, by which the ram is moved

Fig. 111.



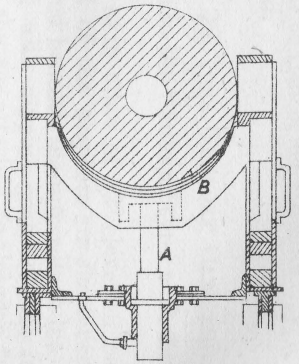
## W. I. TURRET CARRIAGE.

## FOR 10" GUNS OF 18 TONS.




## SECTION SHEWING HYDRAULIC LIFT, A.

*Scale about* $\frac{1}{50}$.




To face page 311.



DANGERFIELD, LITH. 22. BEDFORD ST. COVENT GARDEN.

is double acting. It is contained in a cast-iron box which forms the reservoir, and which is held in a recess in the outer bracket of the carriage; at each end of the reservoir there is a flange with two bolt holes, through which it is bolted to the inner bracket plate. To this plate are attached small pieces of plate iron which abut against the flanges of the reservoir, to steady it; and to support its weight another piece is bolted to the outer bracket plate; strips of leather are also laid between the flanges and the bracket plate.

The spindle for working the pump projects from the side of the box, and is fitted with a double lever; upon the top of the box is a short lever handle for moving the lowering screw plug, and from one end passes a copper tube along the inside of the bracket and through the bottom plate to the ram cylinder, conveying the water from the pump to the latter.

The arrangement consists of two pumps, the plungers of which are in one piece, all the parts to the right of the line OP (neglecting the lowering plug *n*) being exactly the same as those to the left of that line, though in the Fig. the latter only are shown in section. Each pump consists of a cylinder R in which works the plunger A, which is moved by the crank B on the spindle C which carries the lever. E is an inlet valve with strainer D, and G an outlet valve. The channel K, leading from the delivery passage H, is connected with the corresponding channel in the other pump by the tube N. A copper tube L, leading to the ram, is connected with one of the delivery passages, the other being closed by a cap M. The action is as follows:—

Suppose the plungers to move to the right; the water in the pump on the right is forced out through the outlet valve into the delivery passage, and so through the tube L to the ram: at the same time water is drawn into the pump on the left through its inlet valve. When the action is reversed by the lever, and the plungers move to the left, water is drawn into the pump on the right through its inlet valve, and the water in the pump on the left is forced out into the delivery passage, and round through the channel K, and the tube N to the delivery passage of the right hand pump, whence it goes to the ram through L as before.

To lower the saddle and gun, it is only necessary to open the passage *y* by unscrewing the plug *n*, which allows the water to return from the ram cylinder to the reservoir. There is an air screw in the top of the reservoir, and an emptying hole closed by a screw in the front.

In the side of the ram cylinder there is a "check valve," that is, a valve similar to the outlet valve G, but with a small hole through the centre by which the water can return to the reservoir while the valve is on its seat.

At the lower level the saddle rests upon the bottom of its slots in the bracket and at the middle or high level upon blocks of iron H, fitted each with a handle placed in the slots beneath it; the blocks are put in through a slot in the outer plate of each bracket. The following is the elevation and depression which can be given

through the port at each level; namely, low level, 7° to 13° of elevation and no depression; middle level, 7° elevation and 2° depression; high level, $3\frac{1}{2}$° elevation and 6° depression.

The rear rollers run upon an eccentric shaft formed in three pieces and supported in a metal bearing in each bracket plate and in another on the bottom plate. They are thrown into gear by a hydraulic jack, C, Plate LVI, up to 10 tons, which is attached to a crank upon the eccentric shaft by a pin and to the outer bracket of the carriage by a trunnion projecting from its head, which enters and pivots in a small bracket bolted on the top of the carriage bracket. The spindle of the pump crank passes out through the trunnion, and has the usual lever handle fitted to it.

Fig. 112.

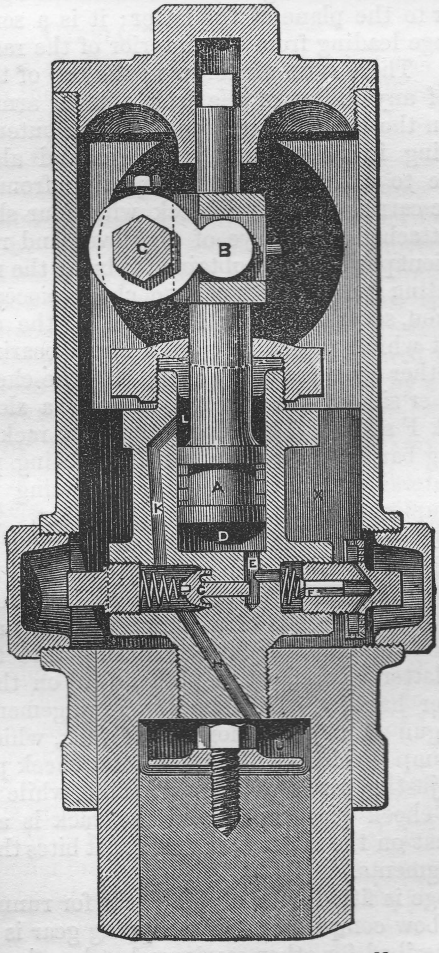



Fig. 112 illustrates the jack for the rear rollers; the pump has a water space at each side of the piston, namely, L above, and D below; F is the inlet valve through which the water is drawn from

the reservoir X only during the upstroke; G is an outlet valve from the space below the piston, through which by the passage H water is delivered to the ram cylinder U; from the space above the piston there is no outlet valve, but a free passage by K and H to the ram cylinder.

Suppose the space D full, and the piston at the end of its upstroke; on its being forced down by the crank B it presses the water through G by K to L, and by H to the ram cylinder where it acts upon the ram. Upon the upstroke of the piston its annular surface, equal in area to half the surface of the lower end, presses upon the water in the space L, and forces it to the ram by the passages K and H; thus, in the upstroke as well as in the downstroke the ram is being acted upon and the work is continuous The relief valve for lowering is not shown in the figure, as it stands perpendicular to the plane of the latter; it is a screw plug which closes a passage leading from the interior of the ram cylinder into the reservoir. There is an air screw in the cap of the reservoir.

In case of any failure of the jack, a lever arm D, Plate LVI, is placed upon the eccentric axle outside the outer bracket of the carriage, having in its extremity an eye and also three metal sheaves, while to a little bracket projecting from the top of the bracket of the carriage, a swivel block with four sheaves is fixed; a fall being attached to the eye of the lever and run through the sheaves sufficient power can be obtained to bring the rollers into play.

The elevating gear consists of two cheek pieces E, Plate LVI, of wrought-iron, secured one on each side of the cascable of the gun, by a bolt which passes through a metal bearing in the latter, and held together by three collar bolts. In the cheek piece, which lies to the inner side of the carriage, there is a slot in which the elevating rack F slides. The lower end of the rack is pivoted upon the connecting bar of the rear roller axles, being prevented from having any lateral motion on the latter by being placed between one of the couplings and the supporting bracket. The rack being fixed, elevation or depression is given to the gun by moving the cascable of the latter along the rack by means of a pinion, which is worked by lever arms G, through the intervention of a train of wheels. The train consists of a pinion (8 teeth) and spur wheel (47) on the same spindle, the former gearing into the rack pinion (15) and the latter worked by a pinion (10) on the same spindle with the lever handles. A clamping arrangement is added for securing the gun at any position on the rack, which consists of a horse-shoe cramp pivoted on the top of one cheek piece, having in one end an adjusting screw with lever handle, while under each end, lying in the cheek piece and upon the rack is a small friction segment, so that on the screw being turned it bites the rack between the friction segments.

The carriage is fitted with nipping gear for running in and out, and with the bow compressor. The nipping gear is similar to that previously described for other carriages, but has the eccentric shafts united at the middle by a coupling, and worked by one lever on the outer side of the carriage; the lever has an eye and single sheaf in

its extremity for a fall, for which a double block is attached to the side of the carriage.

The plates of the compressor at each side are four in number, all hung from supporting brackets upon the side of the carriage, one outside and three inside. Upon the inner side of the carriage two of the inside plates are tapering, but upon the outer side of the carriage none are tapering; the wheel for the adjusting screw of the latter is plain, without notches to take a pawl.

The carriage has also the following minor fitments: a metal bearing for a breeching rope bolted upon the inside of the front transom, round which and through holes in the transom the rope passes; holding down clips upon the front of the same transom; and in the upper part of the front of each bracket, a hole to receive a securing bolt.

### Carriage for "Rupert."

This carriage is similar to the preceding, but the sizes of the blocks supporting the trunnions of the gun are different, and both the ram of the hydraulic lift and the elevating rack are longer.

### Carriage for "Abyssinia."

This carriage has been made for the "Abyssinia" and "Magdala"; it is similar to the "Hecate," but is fitted for additional hydraulic jacks, by which the saddle can be moved in case of failure of the central lift; it is also fitted for a hydraulic buffer in addition to the bow compressor. A strong bearing is attached to the top of each bracket, on which a pulling jack rested, the ram of which projected through the bearing and was secured to the saddle by a bolt. The jacks on each side were connected by a copper tube passing over the gun.

### 11″ R.M.L. of 25 Tons Carriage. "Temeraire" Type.*

11′ R.M.L. of 25 tons, carriage "Téméraire type. L. of C., § 3300.

This carriage is of the same general form as the 10″ "Sultan" type. The brackets are formed each of a $\frac{7}{8}$″ plate riveted on each side of a cast-iron frame $4\frac{3}{4}$″ thick, giving a total thickness to the bracket of $6\frac{1}{2}$″. The bottom plate is 1″ thick, and is attached to the brackets by angle irons; it is bent down to form the well, leaving, however, sufficient space between the well and the sides of the slide for three plates of the bow compressor, with which the carriage is fitted, the plates being suspended through slots cut in the bottom plate; there is also a fourth plate outside.

There are transoms in front and rear; each is of 1″ plate, and is attached to the brackets by an angle iron frame.

The handles of the compressor wheels are single instead of double.

A push jack is fitted to each end of the eccentric shaft.

A breeching loop is bolted on the front of each bracket.

A hydraulic buffer bracket is bolted under the rear of the bottom plate, the buffers being attached to the front of the slide; there are holes in it for two piston rods, which are considerably elongated, to prevent any bending strain on the rods when the rear rollers are brought into action.

* This carriage is also suitable for the "Alexandra."

12″ R.M.L. OF 25 TONS CARRIAGE. "BELLEISLE" TYPE.

These carriages, constructed by the Elswick Ordnance Company, for the "Belleisle" and "Orion," are built on the same general plan as the 10″ carriages "Sultan" type O.P. Their gear and fittings are also similar to those of the latter carriages, with a few exceptions of detail.

The rear rollers and movable blocks of the nipping gear are worked by cranks, instead of eccentrics, on their shafts. The capstan head and ratchet wheel on the right end of the rear roller shaft are of iron instead of metal; and the jack on the left of the shaft is of special pattern.

12″ R.M.L. OF 25 TONS, TURRET CARRIAGE, "GLATTON" TYPE.

This carriage is generally similar to the 10″ carriage "Abyssinia" type.

"MONARCH" TYPE.*

This carriage is generally similar to the 10″ "Hecate" type. It is, however, fitted with a form of Elswick compressor, with worm wheel elevating gear and with a hydraulic buffer.

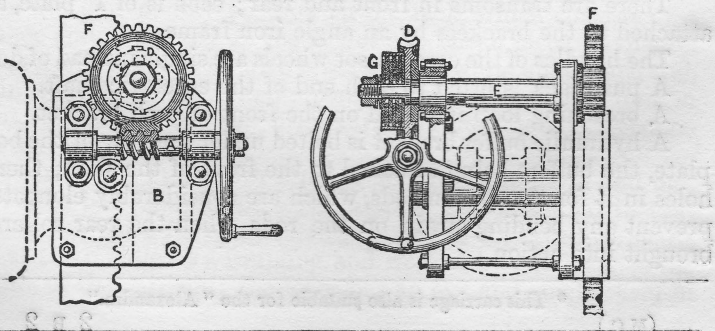
A hollow cast-iron block is bolted to the bottom plate, a little in rear of the bracket supporting the ram, and the compressor bars and plates are pressed against this block by rocking levers from each side. The latter are worked by short shafts passing through the brackets, that on the outer side of the carriage being turned by a four armed lever. The short shafts are each counected by spur pinions, with another shaft lying below them, so that the rocking levers are worked simultaneously.

The hydraulic buffer lies central in the turret slide, the front of it on recoil entering the hollow in the cast-iron block of the compressor gear. The piston rod is not attached to the carriage in the usual way, but has on its extremity a cross-head which slides on the two inner compressor bars of the slide, and which lies between the bracket supporting the ram and the cast-iron block, being driven into the cylinder by the former when the gun recoils, and being drawn out by the latter in running out. The buffer has an internal diameter of 8″, and admits of an extreme recoil of 7′ 7½″; the holes in the piston are ·7″ in diameter.

The carriage is fitted without side holding down clips in front.

§ 4726. The elevating gear, Fig. 113, consists of a steel worm spindle

Fig. 113.




* This carriage is also suitable for the "Hotspur."

(A), which is held horizontally in bearings on the cheek plate (B), conveying motion from a metal handwheel (C), to a metal worm wheel (D), which actuates a steel spindle pinion (E) gearing into the elevating rack.

The worm wheel is cupped out as shown at G, and is connected to the spindle pinion by a series of steel and metal friction plates, alternately keyed to each. The friction between these plates can be regulated by a nut and spring washer, to allow of sufficient slip, and prevent damage to the gear from concussion on firing.

The elevating rack, cheek plate, &c., are similar to those for the 10″ "Hecate" carriage, but the rack, collar bolts and cascable spindle, are of steel.

### 12″ R.M.L. of 35 Tons Turret Carriage, for the "Devastation."*

12″ R.M.L. of 35 tons turret carriage, Mark 1, for the "Devastation."

This carriage is generally similar in form to that of the "Hecate."

The hydraulic lift for the saddle is not part of the carriage but of the ship, and instead of one ram there are two, one to act when the carriage is in the loading position, the other when it is run out.

There is a hole in the bottom plate of the carriage, through which the head of the ram rises to act on the saddle; and in order to ensure the front ram being clear of the carriage before firing, an index handle is placed upon the carriage in rear, connected by a system of levers with an arm movable under this hole and over the head of the ram when down, but which strikes against the ram if the latter be not clear; if the handle can be pushed down, it shows that the ram is clear of the carriage.

The elevating gear is not attached to the cascable of the gun, and has a special arrangement by which its level can be altered to correspond to that of the trunnions of the gun.

An elevating arc is rigidly attached to the gun on the inner side, and into it gears a pinion turned by a four armed lever through a train of spur wheels and pinions. The train is held in two cheek pieces attached to the top of a long vertical screw by a pin.

The pinion is kept in gear with the arc by two bolts through the cheek pieces which work in a slot in the length of the arc. The clamping arrangement is similar to that described for the "Hecate" carriage.

The screw passes through a nut which is held in a bearing bolted to the inside of the inner bracket of the carriage, and which is connected by a bevel gearing with a spindle passing out through the bracket, and having a winch handle on its extremity. This winch handle is turned, and the screw moved up or down as the gun is lifted or lowered by the hydraulic. At low level the end of the screw rests in a metal socket bolted upon the bottom plate, and at middle level on a bracket hinged to the side of the carriage.

The carriage is fitted with the bow compressor, nipping gear, &c., as in the carriage for the "Hecate," with the difference that in the compressor there are two outer plates instead of one upon each side.

The carriage is fitted with two wrought-iron brackets, at the rear of the well, underneath, to take the piston rods of two hydraulic buffers attached to the turret.

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* This carriage is also suitable for the "Thunderer."

# CHAPTER III.—WROUGHT-IRON SLIDES (SHIP) FOR R.B.L. AND R.M.L. GUNS.

The following table gives the slides for R.B.L. and R.M.L. guns in the service:—

| Nature. | Weight with gear. | Tonnage. | Nominal length. | Height to axis of gun, carriage run out. |
|---|---|---|---|---|
| | cwts. | tons. | ft. ins. | ins. |
| R.B.L. | | | | |
| 20-pr., upper deck | 9¾ | 0·733 | 6 7½ | 29·875 |
| 20-pr., gun vessel | 8¾ | 0·653 | 7 6 | 27·00 |
| R.M.L. | | | | |
| 64-pr., 64 cwt., Mark I .. traversing | 24 | 2·502 | 10 6 | 39·50 |
| 64-pr., 64 cwt., Mark II .. traversing | 26½ | 2·702 | 11 1¼ | 39·50 |
| 64-pr., 64 cwt., Mark III .. broadside | 24½ | 2·702 | 9 0 | 37·00 |
| 64-pr., 64 cwt., Mark III .. traversing | 26½ | 2·702 | | |
| 64-pr., 64 cwt., Mark IV .. .. .. | 29¾ | 2·765 | 10 6 | 37·00 |
| 64-pr., 64 cwt., Mark V .. broadside | 28¼ | 3·009 | 10 6 | 37·00 |
| 64-pr., 64 cwt., Mark V .. traversing | 29¾ | 2·765 | | |
| 64-pr., 64 cwt., Mark VI .. traversing | 30½ | 2·765 | 12 1 | 39·50 |
| 7″, 90 cwt. .. .. .. broadside | 41 | 2·624 | 11 0 | 41·00 |
| 7″, 90 cwt. .. .. .. traversing | 43½ | 2·624 | 11 0 | 41·00 |
| 7″, 6½ ton .. .. .. broadside | 44¼ | 2·481 | 12 0 | 41·00 |
| 7″, 6½ ton .. .. .. traversing | 44¾ | 2·481 | | |
| 8″ .. .. .. .. broadside | 60¾ | 4·883 | 13 0 | 44·00 |
| 8″ .. .. .. .. traversing | 67¼ | | | |
| 9″, service .. .. .. broadside | 71 | 5·937 | 14 0 | 44·00 |
| 9″, service .. .. .. traversing | 75½ | 6·093 | | |
| 9″ "Audacious" type .. .. .. | 72¼ | 6·915 | — | — |
| 9″ "Sultan" type .. .. broadside | 62¼ | 7·139 | 12 6 | 43·50 |
| 9″ "Sultan" type .. .. traversing | 64¾ | | | |
| 9″ "Shannon" .. .. broadside | 77¼ | 6·577 | 12 6 | 44·00 |
| 9″ "Shannon" .. .. traversing | 81 | 6·412 | | |
| 9″ "Raleigh" type .. .. .. | 74¾ | 7·139 | — | — |
| 9″ "Lord Clyde" .. .. .. .. | 75½ | 6·093 | — | — |
| 9″ "Plucky" .. .. .. .. | 45½ | 6·336 | — | — |
| 9″ "Staunch" .. .. .. .. | 34¾ | 1·858 | — | — |
| 10″ "Sultan" type .. .. broadside | 132½ | 10·839 | 15 0 | 52·500 |
| 10″ "Sultan" type .. .. traversing | 145¼ | 11·241 | | |
| 10″ "Shannon" .. .. broadside | 122 | 13·650 | — | — |
| 10″ "Shannon" .. .. traversing | — | — | — | — |
| 10″ "Superb," upper deck .. .. .. | 138 | 11·929 | — | — |
| 10″ "Téméraire" .. .. .. .. | 144½ | 10·308 | 15 0 | 49·000 |
| 10″ "Hercules" .. .. broadside | 129¾ | 12·075 | — | — |
| 10″ "Hercules" .. .. traversing | 133½ | | — | — |
| 10″ "Alexandra" type .. chase .. | 144½ | 10·300 | — | — |
| 10″ gunboat .. .. .. .. .. | 82½ | 5·975 | — | — |
| 11″ "Temeraire" type .. .. .. | 166 | 7·468 | 14 8 | 49·00 |
| 12″ "Belleisle" type .. .. .. | 157 | 14·072 | 16 0 | 54·00 |

## 20-PR. R.B.L. OF 13 OR 15 CWT. UPPER DECKS.

**20-pr. R.B.L. of 13 or 15 cwt. slide for upper decks. Mark I.**

This slide (see Fig. 104, page 357) consists of two sides of girder iron, 7″ deep by 4″ wide in the tee, connected by a transom of plate riveted to angle iron in front and in rear. The sides are supported, over front and rear rollers, each upon two forged brackets bolted beneath the girder, so as to stand at a slope of 10°. The

front brackets are connected by a plate placed between them, and to both front and rear brackets flanges are secured to receive the rollers, the brackets in rear having claws to allow of the rollers being easily removed and the slide lowered upon the racer when necessary. (R.C.D. photo-lithograph, 91A.) L. of C., § 2781.

The slide has eye bolts in front and rear at each side, iron stops for the carriage on recoil, and two india-rubber buffers to receive it when run out; the latter are attached to stays for the purpose projecting upwards from the front transom. A batten of sabicu is bolted to the outer side of the web of each girder side for the compressor plate to bear against.

A pivot flap, in one piece, is attached to the head of the slide by a bolt, which passes through its ends and through a bracket bolted to the web of each girder side. The bolt is secured by a key.

The hydraulic buffer with which the slide is fitted rests upon two bearing plates to which it is secured, by holding down bands.

The buffer has a wrought-iron cap at each end; the emptying cock is screwed into the front cap on the under side, and the filling hole plug into the rear cap. The internal diameter of the cylinder is 4″, the holes in the piston are ·47″ in diameter, and the working quantity of oil is 5 quarts. The length of the buffer is such as to admit of a recoil of 2′ 7¼″, but the collar nut on the rod is placed 6″ to the rear of the bracket of the carriage when the connecting nut touches the latter, to allow a "slip" of 6″ on recoil, before the resistance of the buffer begins, which maintains a recoil of 3″.

### 20-pr. R.B.L. Slide, Mark I, Gun Vessel.

The sides of this slide are of the same girders as those of the preceding, but bent round in front to form the head, and connected there by a plate along their webs. They are also connected by a transom in rear, and by bottom plates in front and rear. Beneath the bottom plates there are metal friction plates. Upon the head of the slide there is a metal joint with pivot flap, and in the rear bottom plate, behind the transom, a fighting bolt. 20-pr. R.B.L. slide, Mark I. gun vessel. L. of C., § 3088. R.C.D. photo-litho, 92.

The slide is fitted with a hydraulic buffer; the holes in the piston are ·47″ diameter. A run-off cock is fitted on one side in rear, from which the draw-off measure may be filled. This cock is closed by a screw plug, on the end of which is a leather washer secured by a small screw, the thread of which is left-handed.

The slide is fitted with training gear attached to the rear transom; this consists of a metal hand wheel with pinion, an intermediate wheel and pinion, and a deck pinion to work in a rack formed in the rear racer. The deck pinion is on an eccentric axle to which a lever handle is fixed to enable the pinion to be lifted out of gear when necessary.

### 64-pr. R.M.L. of 64 cwt. Slide. Marks I and II.

The Mark II slides are constructed in the same way as the preceding 20-pr. slide, the sides being of girder iron 7″ deep. 64-pr. R.M.L. slide. Marks I and II.

L. of C., § 2815. R.C.D. photo-litho 148.

The front of the slide rests on rollers and the rear on a block built up of plate and angle iron, with metal friction plates underneath. To admit of the use of the stop handspike in traversing, the rear flanges of the roller feet have projections formed on them, and for a similar purpose in training the bearing plates of the block are thickened.

A bollard is fixed on the transom, and also a bracket with sheave for the running-in tackle.

The traversing roller is on an eccentric axle which is connected with a cross shaft by a pair of bevel pinions, each end of the cross shaft being fitted with a socket for an iron-pointed lever.

The slide is fitted with a bracket for a pivot bar, and also with front and rear joints and flaps for deck pivots, the rear joint being arranged to suit two positions of pivot.

Pivot plates for a rear traversing bar are fitted to the rear of the slide when specially ordered.

L. of C., § 2972.

Bands for a transporting axletree are attached to wrought-iron frames beneath the sides, the frames being of sufficient depth to raise the slide 3″ above the deck when on the transporting trucks. The transporting bracket used is the same as that for 7″ slides. (L. of C. § 1585).

Metal brackets for stowing iron-pointed levers have been added.

It has been approved to fit these slides with rollers in rear, the axles being eccentric and having loops to take the iron-pointed levers.

Eight slides of an experimental pattern, corresponding to the carriages, were issued, and are distinguished as Mark I. They differ from those of Mark II pattern in being 2″ higher and being built up of plate and angle iron. They have no front rollers, but a block with metal friction plate under the head, and another block, with bearings, abont 3′ further back.

The sheave bracket on the rear transom is hinged instead of being fixed, and on the cross shaft of the traversing gear is a segment of a ratchet wheel into which drops a pawl to keep the roller in or out of action.

### 64-pr. R.M.L. of 64 cwt. Slide. Mark III.

64-pr. R.M.L. slide. Mark III. L. of C., § 3090. R.C.D. photo-litho. 149.

This slide is similar in general construction to Mark II slide, but is much shorter and also lower.

It has five compressor bars instead of four, so as to limit the recoil to 4′ 6″. It is fitted with winch gear similar to that of the 7″ of 90 cwt. slide, but of smaller dimensions. A stud for the preventor rope is fitted beneath the rear bottom plate.

Traversing slides, as for ships of the "Medina" class, have traversing gear similar to that on Mark II slides, and for after slides the rear pivot is removed 9″ further to the rear; the flap is made of wrought-iron, and is attached to the slide by pivot-head brackets similar to those for traversing bars for 7″ of 90 cwt. slides. They are also fitted with the ordinary flap for front deck pivot; and the traversing gear, can, however, be taken off, so that the traversing slide will be interchangeable with the broadside slide.

This slide has the same transporting arrangements as the Mark II slide, but the broadside slide has a special transporting bracket bolted on in front. The transporting axle for ships of the "Medina" class is 4′ 5″ long, instead of 4′ 8″.

### 64-pr. R.M.L. of 64 cwt. Slide. Mark IV.

This slide is a converted Mark III, and is similar in all respects to Mark V. § 4192.

### 64-pr. R.M.L. of 64 cwt. Slide. Mark V.

This slide is generally similar to Mark III.

§ 4192. R.C.D. photo-litho. 149A.

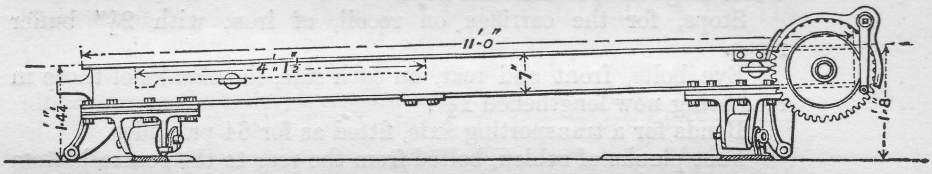
It is supported both front and rear on gunmetal rollers coned to the radii of the racers, and is fitted with training gear. The gear consists, Fig. 105, p. 360, of a pinion (G) geared into a rack on the deck, and driven by means of a spur wheel and pinion by the handwheel (K). The spur wheel is clamped by a friction bow (H).

The pinion (G) is lifted out of gear with the rack by means of a lever on the right side, secured in position by a pin. This pinion is arranged so that the training rack is level with the top of the racers.

### 64-pr. R.M.L. of 64 cwt. Slide. Mark VI.

This slide is a converted Mark II; it is fitted with front and rear rollers and training gear similarly to Mark V, but is not fitted with winch gear, having instead running back sheaves similarly to Mark II.

Fig. 114.




### 7″ R.M.L. of 90 Cwt. Slide. Mark I.

7″ R.M.L. of 90 cwt. slide. Mark I. (R.C.D. photo-litho-graph, 145.) L. of C., § 2668.

This slide, Fig. 114, consists of two sides connected by a transom, and three bottom plates, it is fitted with rollers secured in flanged feet.

The sides are of girder iron, 7″ deep and 5″ wide in the flange, bent round to meet in front. The transom is of angle iron and the bottom plates ¾″ thick.

The sides have a slope of 1½° (in addition to 2° given by the deck), and are connected in front by plates lapping over their junction and bolted to them, the outer plate also serving as one of the pivot plates for the connection of the pivot bars, while the inner forms the support for the front pin of the compressor bars. In rear the sides are connected by the transom, which is bolted to them. The front bottom plate is bolted beneath the head of the slide and

the rear a little to the front of the transom. The centre bottom plate is attached by clips bolted to it.

The flanges for the rollers are bolted beneath the bottom plates immediately under the sides, packing pieces being placed between the rear plate and the rear flanges. The latter flanges are made with claws in order that the rollers may be readily unshipped, metal friction plates are bolted to these flanges, which take the bearing on the racer when the rear rollers, which have eccentric axles, are not in action.

L. of C., § 2755. The rollers are secured upon 2″ axles. which are keyed upon the outer side; the axles of the rear rollers have each a loop formed on the rear extremity to receive the iron-pointed lever for throwing the roller into gear.* A guard is added to each rear roller, which serves as a pointer in laying and also as a stop against which the stop handspike can bear.

The slide is fitted for the Elswick compressor, the supporting pin for the bars being 2″ in diameter. The slide is also fitted with two hydraulic buffers, one inside each side, butting against a strengthened angle iron forming the rear transom, and supported in front upon an additional piece of angle iron secured under the slide. They are 4″ in internal diameter, and admit of a maximum recoil of 5′ 6⅜″, a slip of 20⅜″ being allowed on the rods.

The holes in the piston are ·35″ in diameter, and the working quantity of oil is 11 pints. The screws in the plugs of the run-off cocks have left-handed threads. The diameter of the piston rod is now increased to 2¼″.

The slide has also the following fitments:—

Stops, for the carriage when run out, of wood, with 3″ india-rubber buffer rings on spindles with keys.

Stops, for the carriage on recoil, of iron, with 2½″ buffer rings.

Eye bolts, front and rear, on each side, the shanks of those in rear being now lengthened 1½″.

Bands for a transporting axle, fitted as for 64-pr. slides.

Foot planks of sabicu, bolted from the rear to the centre bottom plate.

Bollard with hook, bolted to the rear transom.

A metal flap hinged by a pin with key to a metal joint bolted beneath the front bottom plate; this flap is intended for housing the slide inboard to the deck pivot, and when not in use is held up by a catch on the head of the slide. A similar metal flap for pivoting is attached to another metal joint bolted beneath the rear bottom plate.

L. of C., § 2888. The pivot bars are attached by bolts with keep pins to pivot plates, for the purpose, upon the head of the slide.

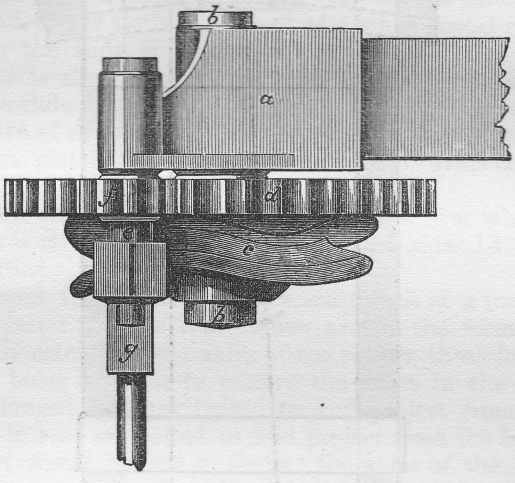
†Winch gear, Fig. 115, consisting, on each side, of a cast-iron spur wheel, *d*, and serpentine wheel, *c*, in one, secured by a

* The rollers of slides for the "Raleigh" are stamped with the letter "R." They are coned to the following radii, viz., front 3′ 4¾″ rear 11′ 7½″.

† Blocks for winch gear are supplied in sets of six, viz.: 2 training, with thimble; 2 training, without thimble; and 2 running in and out.

collar and split key on a gudgeon, *b*, bolted to the side of the slide in rear; the spur wheel is driven by a pinion, *f*, secured by a collar and split key on a spindle, *e*, the latter being held in a bracket, *a*,

Fig. 115.




bolted on the end of the slide, and being worked by a winch handle. *g*. A metal guard covers the spur wheel and pinion.

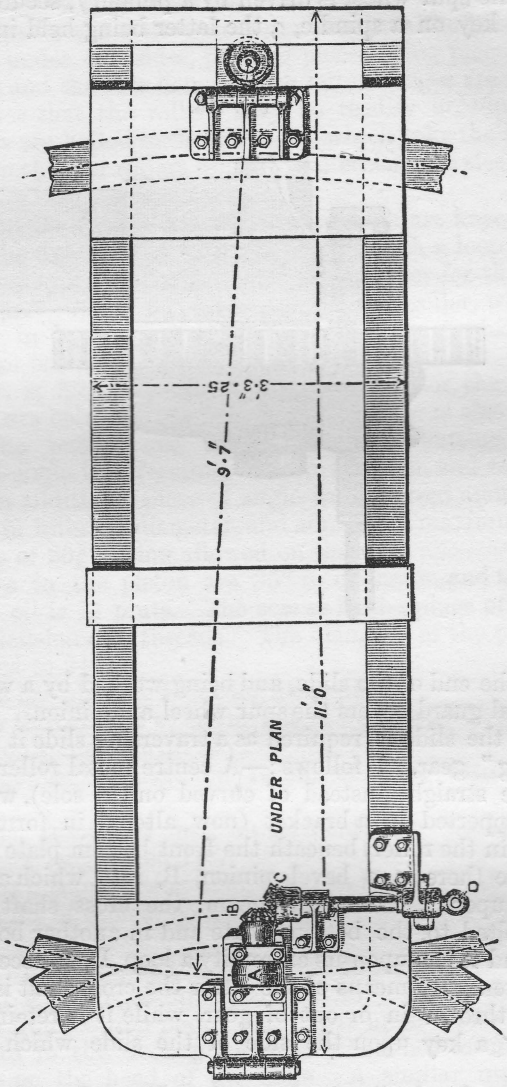
When the slide is required as a traversing slide it is fitted with "traversing" gear, as follows:—A centre metal roller, A, Fig. 116 (now made straight instead of curved on the sole), with eccentric axle, is supported in a bracket (now altered in form to suit the alteration in the roller) beneath the front bottom plate; on the end of the axle there is a bevel pinion, B, into which another bevel pinion, C, upon a cross shaft gears; the cross shaft is held in a bracket bolted to the bottom plate and in another bolted beneath the side, and it has upon its extremity a loop, D, to receive the iron-pointed lever. By means of the latter the cross shaft is turned and the roller thrown in or out of gear, while it is retained in either position by a key upon the side of the slide which secures the shaft.

The stop handspike in traversing is used against the rear flange of the front roller foot, which is made thick for the purpose.

Pivot plates for a rear traversing bar are fitted to the rear of the slide when specially ordered. L. of C., § 2873.

In the traversing slides of the "Arab" and "Lily," an elongated metal flap (in addition to the ordinary one) for traversing has been added, giving an increased distance of 9″ between the centres of the joint and pivot hole; the flap is fixed to a joint in rear of the ordinary one.

Fig. 116.




7″ R.M.L. OF 6½ TONS SLIDE. MARK I.

7″ R.M.L. of 6½ tons slide. Mark I. (*See* R.C.D. photo-lithograph, 81B.)

The slide consists of two sides, two transoms, two bottom and one top plate, a diagonal stay, a block, and four flanged feet with rollers.

The sides are bent round in the usual manner in front, and united by a connecting plate upon the inside. They have a slope of $1\frac{1}{2}°$ in addition to 2° given by the deck.

The front transom connects the sides about 15″ from the head;

it is formed of $\frac{7}{8}$" plate with a piece of angle iron riveted along the upper edge.

The top plate is $\frac{3}{4}$" thick, and is bolted over the head and front transom; it has a large slot in it to give access to the parts beneath.

The rear transom is of angle iron bolted to the rear extremities of the sides.

The front bottom plate is bolted beneath the sides about 10" from the head, and is slotted to admit of a centre metal roller being placed when the slide is used as a "traversing" one. The other bottom plate is slightly bent down and secured by clips across the centre of the slide.

The centre of the diagonal stay rests upon and is bolted to the latter bottom plate, and the extremities of its arms bolted to the girder sides.

The block consists of a frame of angle iron over which a piece of plate iron is riveted; it is bolted beneath the sides 14" from their rear extremities.

The flanged feet for the rollers consist each of a fore and hind flange; the latter for the rear rollers are in the form of simple hooks, which catch over the axles of the rollers, those for the front rollers have holes in them to receive the axles in the usual way. The front flanged feet are bolted to and project from the sides, while those in rear are bolted to and project from the block. The rollers are of metal, conical in shape: the axles of the rear rollers are eccentric, and formed each with a loop to receive the iron-pointed lever.

A guard plate, which serves as a pointer, is fitted over each rear roller, secured to small iron brackets attached to the flanges of the foot.

The ends of the block and of the front bottom plate are shod with metal friction plates to take the bearing on the racers; the spaces between the block and its friction plates are filled in with wood to prevent injury to the block by the lodgment of salt water.

The slide is fitted in the usual manner for the Elswick compressor, and has also the following fitments, namely:—

Stops for the carriage when run out and on recoil.

Metal stops under the sides in front for the stop handspikes to bear against in traversing.

Sabicu foot planks resting on the block and on the diagonal stay.

A folding platform attached to the rear of the slide. L. of C., § 2946.

A bollard, eyebolts, and winch gear, as in the slide for the 7" gun of 90 cwt.

Metal joints with flaps, one for housing inboard on the head of the slide; one, for pivoting, on the rear of the block.

Pivot plates with pivot heads for the attachment of pivot bars bolted upon the top plate; the pivot plates are now of increased thickness. L. of C., § 2740.

A metal bracket bolted to the front bottom plate to receive the

eccentric axle of a centre roller when the slide is used as a "traversing" one; upon the front of the bracket a small iron plate is fitted to prevent the axle from falling out in traversing; the axle has a loop upon the extremity for the iron-pointed lever.

Axletree bands to receive a transporting axle bolted beneath the sides in front of the block.

The slides for the "Viper" and "Vixen" are special for those vessels.

## 8″ R.M.L. of 9 Tons Slide.

8″ R.M.L. of 9 tons slide. Mark I. (R.C.D. photo-litho-graph, 147, 147A.)

This slide is similar to that for the 7" gun of 6½ tons, but the rear transom is of 1" plate let into the sides and secured to them by knees; a third bottom plate is also added beneath this transom.

The slide is now fitted with centre planks, which form a platform between the sides of the slide in rear, resting on blocks so as to raise the upper surface as high as the carriage will admit. An opening covered by a movable plate is made through the planks to enable the rear pivot flap to be lifted.

The slide is not fitted with winch gear, but instead with gear for running in and out, training and traversing.

The running in and out gear is as follows:— (See Fig. 117, which is that of a 9″ slide with two chains).

An endless chain extends from front to rear of the inside of the slide on the left, supported on chain wheels. The front chain wheel is pinned to an adjusting screw, *a*, by which its tension can be regulated, and the rear wheel keyed to a cross shaft. The adjusting screw passes through the head of the slide and the front transom, and is secured by two nuts, a metal bearing or socket being bolted upon the front transom for it, in which are placed india-rubber rings separated by washers.

The cross shaft is made in two pieces coupled together by a cylinder and pins; it passes through the girder sides and is supported by two metal brackets bolted upon the rear bottom plate; it is worked by a winch handle, pinion, and spur wheel, *b*, outside the slide on either side. The spur wheel and pinion are covered by a metal guard bolted to the slide, in which the bearing for the spindle of the pinion is formed. Upon the inside of the spur wheel, cast in one with it, is a ratchet wheel in which a movable pawl, pivoted to a socket on the side of the slide, gears.

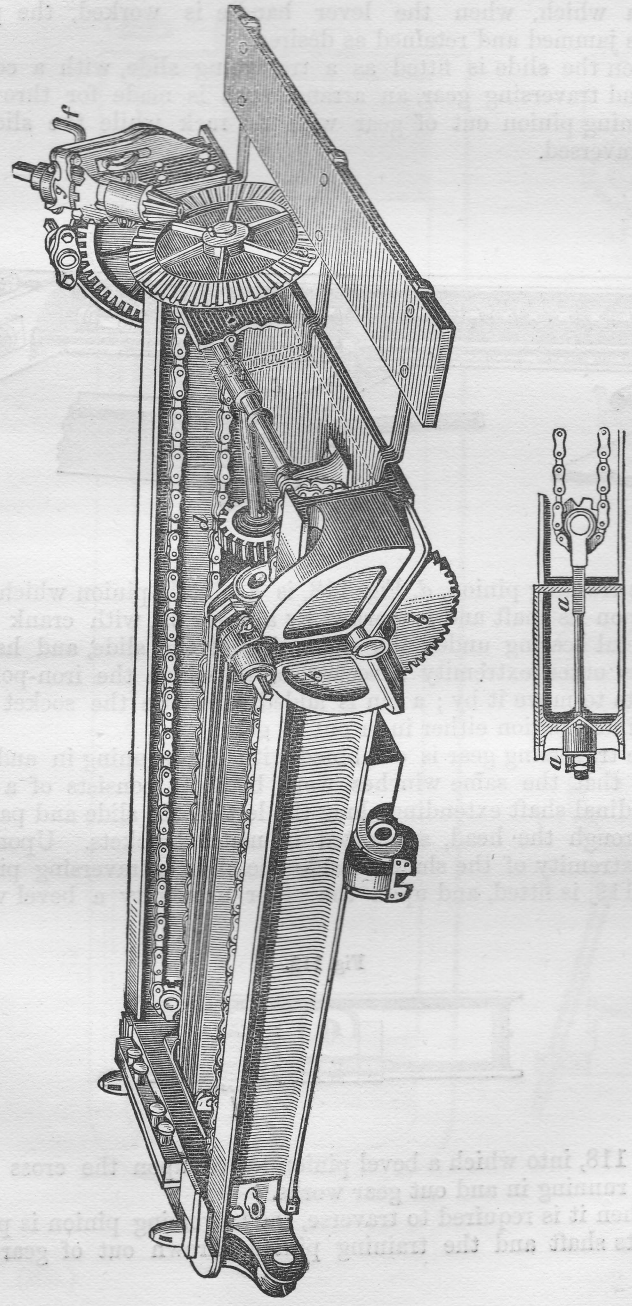
Two small metal brackets (not in Fig.) are bolted to the metal guard, in which the winch handles when not in use can lie.

The training gear consists of the following:--

A short longitudinal shaft, supported in a metal bearing upon the block, and in another upon the rear transom, has keyed upon its front extremity a metal pinion *d*, which gears in a metal rack upon the deck, and upon its rear extremity a metal crown wheel, *e*, the latter of which is set in motion by a pinion and winch handle at the right side of the slide. The spindle of the pinion is held in a metal bracket bolted upon the end of the side of the slide; an arrangement to pawl it, and so fix the slide to any point on the deck, or gradually control its motion, is added, consisting of

a pawl wheel, pawl, and screw break. The pawl wheel is in one with the spindle of the pinion, and the pawl is hinged to the bracket by a bolt with a collar and keep pin. The screw break is in the form of a small bow or cramp, pivoted by a screw in the

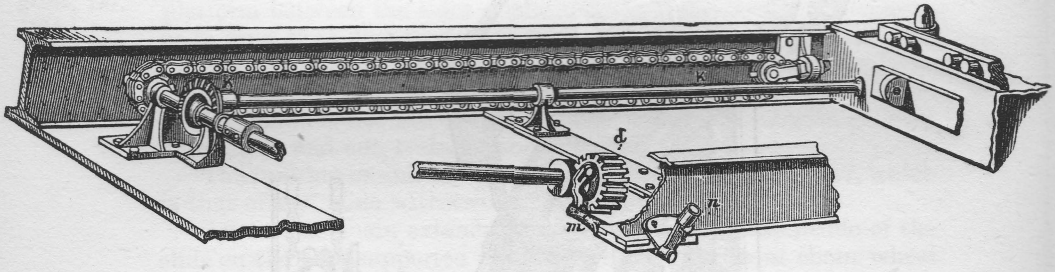
Fig. 117.



centre on the metal bracket at the end of the slide, with the pawl wheel between its arms ; on one of the latter is a small projecting piece, and in the other a screw worked by a lever handle, *f*, attached by a fixed screw; under the projecting piece, and under the screw lying upon the pawl wheel are small friction pieces, between which, when the lever handle is worked, the pawl wheel is jammed and retained as desired.

When the slide is fitted as a traversing slide, with a centre roller and traversing gear, an arrangement is made for throwing the training pinion out of gear with its rack while the slide is being traversed.

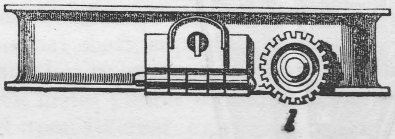
Fig. 118.



The training pinion, *d*, Fig. 118, is a clutch pinion which can slide upon its shaft and is worked by a lever *m*, with crank held in a metal bearing under the right side of the slide, and having upon its outer extremity a socket, *n*, in which the iron-pointed lever fits to move it by ; a pin is added to secure the socket with the training pinion either in or out of gear.

The traversing gear is combined with the running in and out gear so that the same winches work both; it consists of a long longitudinal shaft extending along the left of the slide and passing out through the head, supported in metal brackets. Upon the front extremity of the shaft, outside the slide, a traversing pinion, *l*, Fig. 119, is fitted, and upon the other extremity a bevel wheel

Fig. 119.



*k*, Fig. 118, into which a bevel pinion keyed upon the cross shaft of the running in and out gear works.

When it is required to traverse, the traversing pinion is placed upon its shaft and the training pinion thrown out of gear; the

traversing shaft is then worked as desired, by the winches of the running in and out gear (the chains of course detached from the carriage). When the traversing is completed, the traversing pinion is removed and the training pinion thrown into gear again.

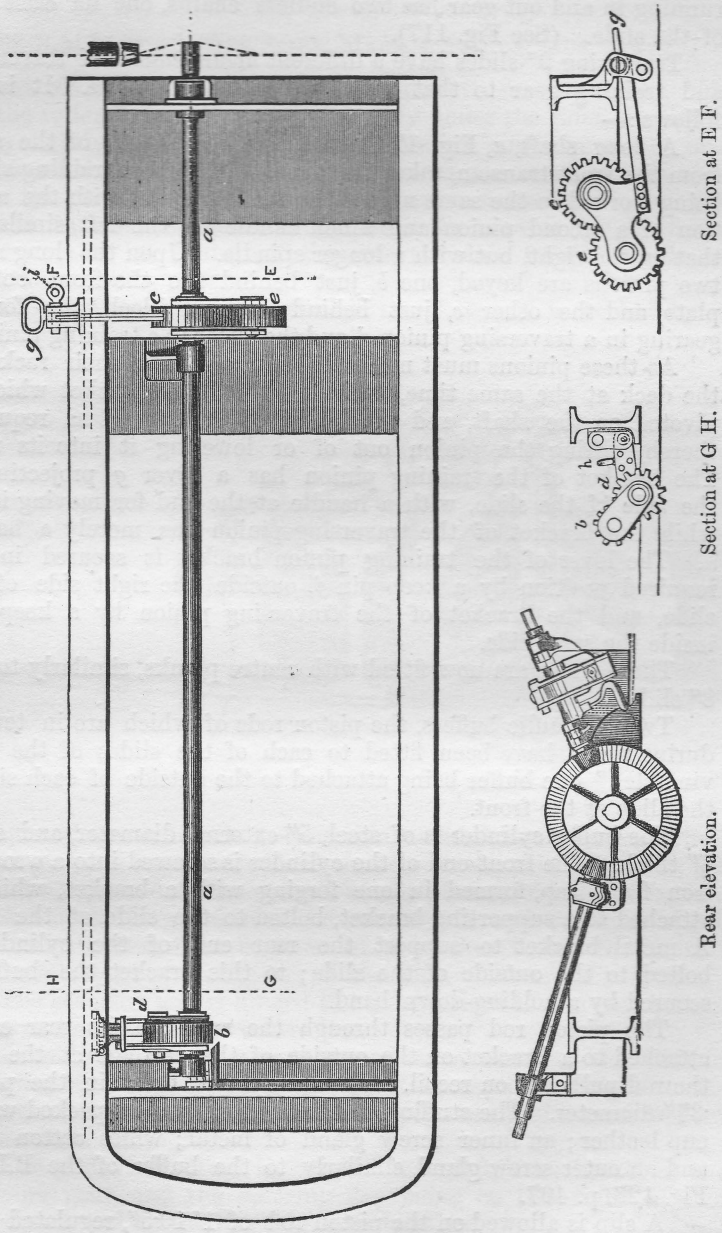



Fig. 120.

## 9″ R.M.L. of 12 Tons Service Slide.

9″ R.M.L. of 12 tons slide. Mark I. (R.C.D. photo-litho-graph, 146.)

This slide is similar to the preceding, and fitted for the Elswick compressor and with running in and out and training gear, but the running in and out gear has two endless chains, one on each side of the slide. (See Fig. 117).

Traversing 9″ slides have a different arrangement of traversing and training gear to that described for the 8″ slide. It is as follows:—

A long shaft, *a*, Fig. 120, extending the length of the slide from the front transom, takes the place of the short training shaft, being worked in the same manner as the latter, but with the addition of a second pinion and winch handle on the left, similar to that on the right, but with a longer spindle. Upon the long shaft two pinions are keyed, one *b*, just behind the the front bottom plate, and the other *c*, just behind the rear block, the former gearing in a traversing pinion *d*, and the latter in a training pinion *e*.

As these pinions must not both be in gear with their racks on the deck at the same time, each is held in a bracket which is pivoted on the shaft, and can be raised or lowered as required, thereby lifting the pinion out of or lowering it into its rack. The bracket of the training pinion has a lever *g* projecting to the side of the slide, with a handle at the end for moving it by, while the bracket of the traversing pinion has merely a handle *h*. The lever of the training pinion bracket is secured in any required position by a keep pin *i*, outside the right side of the slide, and the bracket of the traversing pinion by a keep pin inside the same side.

These slides are now fitted with centre planks, similarly to the 8″ slides.

Two hydraulic buffers, the piston rods of which are in tension during recoil, have been fitted to each of the slides of the "Invincible;" one buffer being attached to the outside of each side of the slide at the front.

The buffer cylinder is of steel, 5″ external diameter, and about ½″ thick. The front end of the cylinder is screwed into a wrought-iron front cap, formed in one forging with a bracket, which is attached to a supporting bracket, bolted to the slide, at the head. A metal bracket to support the rear end of the cylinder, is bolted to the outside of the slide; to this bracket the buffer is secured by a holding-down band.

The piston rod passes through the rear cap, its rear end is attached to a bracket on the outside of the carriage at the rear; the rod pulls out on recoil. There are three holes in the piston, ·37″ diameter. The stuffing box in the rear cap is packed with a cup leather; an inner screw gland of metal; white cotton rope; and an outer screw gland, similarly to the buffer of the B.L. 4″, Fig. 128, p. 407.

A slip is allowed on the piston rod of 1′ 10·5″, regulated by a collar attached to the rod by two set screws.

Working contents of cylinder, 7½ quarts. To prepare for firing

the buffer should be filled with the carriage run out to the front stops and $1\frac{1}{4}$ pints drawn off.

Hangers for drip pan No. 4 for the glands and run-off cocks are attached to the outside of the slide at the position of the front and rear caps.

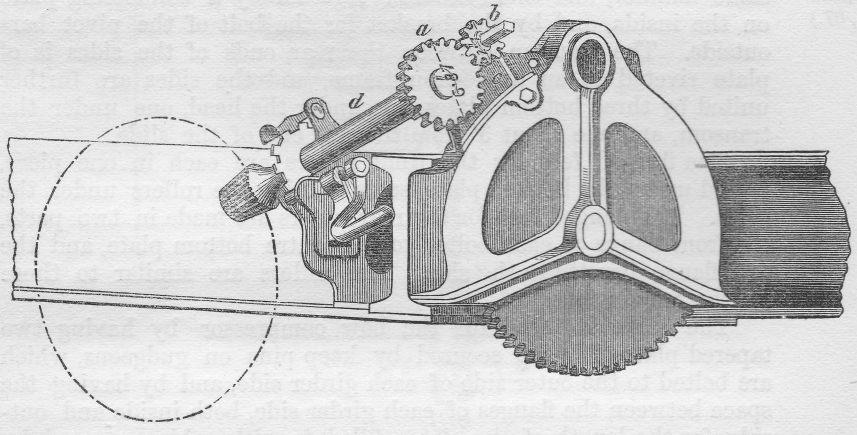
### 9″ R.M.L. of 12 Tons Slide, Mark I, "Audacious" Type.

9″ R.M.L. of 12 tons slide, Mark I, "Audacious" type.

This slide is similar to the service pattern just described, but has the roller flanges placed immediately under the sides, the latter being slightly recessed to admit the rollers. The rear rollers are hollow-soled or grooved to run upon ribs on the racer, in order to assist the pivot and pivot bars; they are not eccentric, and are secured in their flanged feet in the same manner as the front rollers. A tie bar is also added across the slide from one axle to the other of these rollers.

The training shaft lies central in the slide, and is worked by a

Fig. 121.




pinion and winch handle at each side, an additional toothed wheel *a* and pinion *b* being introduced to increase the gain of power, the former on the end of the spindle of the pinion, and the latter in a bracket upon the guard over the running in and out spur wheel. The brake arrangement is fitted in a bracket bolted to the rear transom instead of on the end of the slide.

The securing flap is hinged to a joint bolted to the rear bottom plate on one side of the centre line.

A holding-down hook, for the purpose of securing the slide in a seaway and also assisting the pivot in recoil, is bolted to the bottom plate; it catches under the projecting lip of a racer secured to the deck.

The slides are fitted as "right" or "left," the brake on the training gear, and the securing flap being on the right side of left slides, and on the left side of right slides.

Spare slides of this type are made to be capable of being used either as right or left. They have on both side fittings

for a brake bracket, and a joint for a securing flap, and these can be arranged as may be required.

The upper deck slides of the "Invincible" have been fitted with hydraulic buffers, similarly to the main deck slides, p. 390. The buffers are not interchangeable with those of the main deck slides; the cylinders and piston rods of the upper deck slides being shorter, the working contents, 7 quarts; and the slip allowed on the piston rods, 2′ 4·5″.

This type of slide is suitable for the upper decks of the "Audacious," "Invincible," "Triumph," "Iron Duke," and "Swiftsure."

### 9″ R.M.L. of 12 Tons Slide, "Sultan" Type.*

9″ R.M.L. of 12 tons slide, Mark I, for "Sultan." (*See* R.C.D. photo-lithograph, 87.)

The main difference between the "Sultan" and the service slide is the greater height of the former.

The slide is formed of two girder sides, 10″ deep by 5″ wide in the flange, as in the service pattern, bent round in front in the same manner, and there secured together by a connecting plate on the inside, and by the bracket for the bolt of the pivot bars outside. The transom between the rear ends of the sides is of plate riveted to an angle-iron frame, and the sides are further united by three bottom plates, one under the head, one under the transom, and one about 3′ from the rear end of the slide.

The flanged feet for the front rollers are each in one piece, bolted under the bottom plate, so as to bring the rollers under the sides. The flanged feet for the rear rollers are made in two parts, the front flange of each bolted to the centre bottom plate, and the rear flange directly to the side. The rollers are similar to those for the "Audacious."

The slide is fitted for the bow compressor by having two tapered plates 7″ deep secured by keep pins on gudgeons, which are bolted to the outer side of each girder side, and by having the space between the flanges of each girder side, both inside and outside, for the length of the plates, filled in with sabicu, secured by screws.

Upon the inside of the head of the slide a buffer plate is bolted, to which a wooden buffer block, with four plates of india-rubber intervening, is attached by two bolts to receive the carriage when run out. Two similar small buffers (with five india-rubber plates) are attached to iron stops bolted to the rear bottom plate, one at each side, to receive the carriage on recoil.

The slide is fitted with running in and out gear, as already described, but having a single chain only upon the left (as in the 8″ service pattern), and the cross shaft for the chain wheel in one piece, with the spur wheels secured upon its extremities by keys.

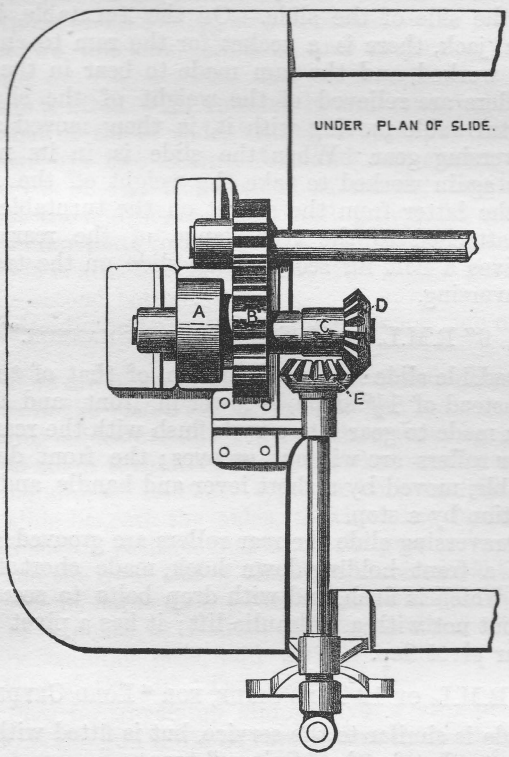
The training shaft lies central in the slide, as in the 9″ slide for the "Audacious," and is worked, as in that, by two levers, with a second wheel and pinion for each to increase the gain of power. The shaft is supported in front in a semicircular-shaped

* This slide is suitable for the "Sultan," "Excellent," "Cambridge," "Neptune," "Nelson," and "Northampton."

plate riveted by means of angle iron to the under side of the centre bottom plate.

The slide is fitted with two central foot-planks.

Fig. 122.




Traversing slides have the combined training and traversing gear, as described for the 9″ service pattern slide, with the difference that the centre front roller A, Fig. 122, is connected with the traversing pinion B, and both are thrown in and out of action by the same operation. This is effected by placing the connected roller and pinion on an eccentric axle C, having a mitre pinion D, on its rear extremity. In this pinion another mitre pinion E, on the end of a short cross shaft, which projects at the side of the slide, gears, while on the projecting end of the shaft there is a loop to take the iron-pointed lever. As the shaft is turned it raises or lowers the roller and traversing pinion, and the latter are secured either in or out of gear by pinning the shaft to a small bracket outside the side of the slide.

A holding-down hook, similar to that on the 9″ slide for the "Audacious," but not rigidly bolted to the slide, is fitted upon the head of the slide; it is retained when in action by means of a bolt. A sabicu foot plank is fixed down the centre of the slide.

### 9″ R.M.L. of 12 Tons Slide, "Raleigh" Type.*

This slide is similar to that for the "Sultan," but is fitted to traverse on a turn table. A solid beam of iron, 3″ thick by 10″ wide, is bolted beneath the girder sides near the centre, to which is fixed a differential hydraulic jack (Tangye's) worked by a lever at the side of the slide. On the turntable, beneath the ram of the jack, there is a socket for the ram to enter. When the jack is worked, and the ram made to bear in the socket, the training rollers are relieved of the weight of the slide, and the latter, the turntable moving with it, is then moved as required by the traversing gear. When the slide is in its new position the jack is again worked to take the weight off the ram, and to withdraw the latter from the socket on the turntable. A metal bracket is attached to the rear flange of the rear roller foot, which receives a bolt for securing the slide on the turntable previous to traversing.

### 9″ R.M.L. of 12 Tons Slide, "Shannon."

The broadside slide is a modification of that of the "Sultan." It has 3° instead of $1\frac{1}{2}$° slope, is lower in front, and the training deck pinion made to gear into a rack flush with the rear racer.

The rear rollers are without grooves; the front deck pivot is made portable, moved by a short lever and handle, and kept in or out of position by a stop.

In the traversing slide the rear rollers are grooved; the slide is fitted with a front holding-down hook, made short to clear the deck racer, which is flush, and with drop bolts to secure it to the turntable, but not with a hydraulic lift; it has a pivot bar, but no front or rear pivot flap.

### 9″ R.M.L. of 12 Tons Slide, for "Lord Clyde."†

This slide is similar to the service, but is fitted with traversing gear similar to that for the "Sultan" type.

### 9″ R.M.L. of 12 Tons Slide, for "Plucky."

This is similar to the 10″ gunboat slide, but is fitted for the E.O.C. compressor.

### 10″ R.M.L. of 18 Tons Slide, Mark I. "Sultan" Type.

10″ R.M.L. of 18 tons slide. Mark I, for "Sultan." (*See* R.C.D. photo-lithograph 91.

This slide is similar in construction to the 9″ slide for the "Sultan," and fitted like it for the bow compressor. The girder sides are $11\frac{3}{4}$″ deep by $5\frac{1}{2}$″ wide in the flange, slope $1\frac{1}{2}$°, and are connected by a front transom and top plate in addition to the three bottom plates and rear transoms, and the front as well as the rear rollers are grooved.

The front buffer to receive the carriage, when run out is similar to the front buffer of the 9″ slide, but with six india-rubber plates; it is attached to the front transom. The rear buffer is also of

* This slide is suitable for the "Raleigh" and the "Shah.

† This slide is suitable for the "Lord Clyde," "Achilles," "Agincourt," "Minotaur," "Northumberland," and "Lord Warden."

similar form, with eight plates, and is attached to a stay of plate iron bolted to the rear bottom plate by means of angle iron, and to a top plate which lies over and is bolted to the rear transom. An iron stop is also bolted to each girder side to receive the carriage when the rear buffer has been compressed 4″.

A side step is bolted, on each side of the slide, to iron brackets for the purpose, and a folding step is placed at the rear of the slide attached to two brackets bolted to and projecting from the rear bottom plate.

The slide is fitted with running in and out and training gear similar to that of the 9″ slide, "Sultan" type, but the running in and out gear has two chains, &c., and the crown wheel of the training gear is of cast iron instead of metal; the latter gear is also without the additional wheel and pinion for gain of power. The semicircular plate to which the front bearing bracket of the training shaft is attached, is bolted to the girder sides a little in front of the second bottom plate.

Two hydraulic buffers are fitted one on each side of the training shaft.

The buffers are 6″ in internal diameter, and allow a recoil of 6′, the holes in the piston are ·6″ in diameter.

Traversing slides are not fitted with traversing gear, but are traversed on small turntables in a somewhat similar manner to the 9″ traversing slides, "Raleigh" type. A built-up iron beam is fixed across the slide beneath the sides, to which the hydraulic jack is attached, in such a position that when the gun is run in and the pump worked the front end of the slide is raised off the deck, and the whole weight borne on the turntable, which is then traversed by means of winches, as desired. They are fitted with additional power to the training gear, and with a brake on the rear racer similar to that of the 10″ "Temeraire" type.

The buffers for traversing slides have a slip of $9\frac{1}{4}$″ on their piston rods, as the gun must be run further in so that the muzzle may clear the ship's side; the holes in their pistons are ·57″ in diameter.

### 10″ R.M.L. 18 Ton Slides for "Hercules."

The slides are similar to those of the "Sultan" type, but are 3″ less in height, which involves a difference in the depth of the roller flanges, in the shape of the holding down hook, and in the depth of the front bearing plate of the training shaft.

The width between the centres of the hydraulic buffers is 3″ greater, and between the sprocket wheels $1\frac{1}{4}$″ less.

### 10″ R.M.L. of 18 Tons Slide, for "Temeraire."

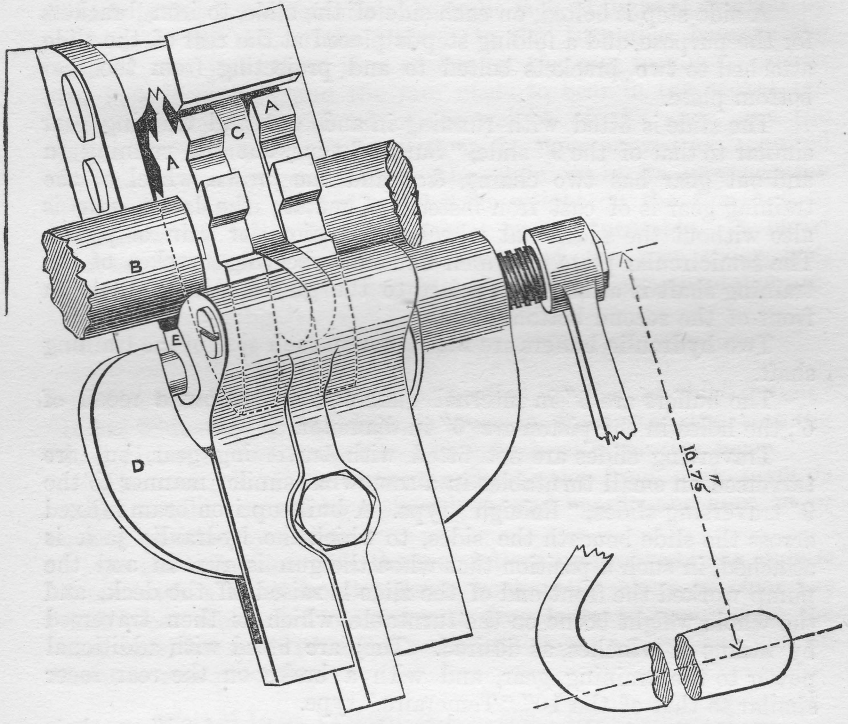
10″ R.M.L. of 10 tons slide, Mark I, "Temeraire" type.

The slide is similar to that for the "Hercules," but with the radii of the racers reduced to 5′ $11\frac{1}{2}$″ in front and to 15′ $2\frac{1}{2}$″ in rear, with additional power to the training gear and with the brake gear modified, so as to double the frictional resistance. The latter

L. of C.. § 2803.

is arranged as follows:—The brake, wheel, Fig. 123, is divided into two discs A, A, with feathers to allow of their sliding upon the plnion shaft B. Between the discs a circular friction plate C, is

Fig. 123.




attached to the supporting bracket of the shaft; against this the discs are pressed by the cramp D and friction segments E, four frictional surfaces being thus subjected to pressure.

The "bow" and "stern" slides for the "Temeraire" are of the "Alexandra" type.

## 10″ R.M.L. of 18 Tons Slide, "Alexandra" Type.*

This slide is similar to the "Temeraire" broadside, but is fitted with a brake on the rear racer.

The brake consists of two similar parts, each nipping the racer independently of the other. Each consists of a cramp similar in general form and arrangement to that of the brake on the training gear, the rib of the racer taking the place of the pawl wheel. Each is worked by a lever 3″ long, moving in a vertical plane, which fits on a short longitudinal spindle at the rear of the slide. On the front end of this spindle is a short arm at right angles to it, and there is a similar arm on the screw of the cramp, these two arms

* This slide is suitable for the "Alexandra," "Nelson," and "Northampton."

having screws pivoted to them which are connected by an adjusting nut. When the levers are forced towards the centre of the slide, the screws of the cramps are turned, and the rib of the racer is grippled between the friction pieces.

A movable platform is attached in rear of the slide for convenience in working the levers.

### 10″ R.M.L. of 18 Tons Slide for "Shannon."

This differs from the "Temeraire" slide only in having a shorter holding down hook.

### 10″ R.M.L. of 18 Tons Slide for Upper Deck "Superb."

This slide is similar to the "Temeraire" type, but it is one foot shorter and the chains, traversing shaft, compressor bars and shaft on rear racer brake are shortened to suit the slide.

### 10″ R.M.L. of 18 Tons Slide, Gunboat.

Each slide of the above description is special to the particular vessel for which it is intended, owing to the difference between the deck fittings of vessels of this class.

10″ R.M.L. of 18 tons slide Mark I, for gunboats. (*See* R.C.D. photo-lithograph, 88B.)

The slide is similar in the construction of the frame to the 10″ "Sultan" type, and fitted for the bow compressor. It has no rollers, but the sides are supported at the required slope of $3\frac{1}{2}°$ by forged iron stays or brackets under each, each stay at one side being connected with the corresponding stay of the other side by a tie bar. Beneath the head of the slide and beneath the stays metal friction plates are secured to take the bearing on the racers.

The slide is pivoted near the front immediately under the centre of gravity of the system when the carriage is run out, a pivot plate for the purpose being bolted across beneath the sides.

A folding step is attached to the slide in rear, but there are no side steps.

For the breeching rope to bear against a wood cushion is fitted round the head of the slide, and at each side a metal loop is bolted over it, through which the rope passes to the carriage.

Upon the head of the slide a loading derrick is pivoted, a plate for the purpose, on each side, being secured to the cushion and the girder side.

The slide is not fitted with running in and out, training, or traversing gear, but for running the carriage in, two metal sheaves are pivoted in a metal bracket bolted on the rear bottom plate; through these sheaves and through two corresponding ones on the carriage a fall is rove and worked by a steam winch. On one side of the metal bracket a bollard with a hook is fixed.

A fixed iron securing flap is attached to the connecting bar of the rear side stays.

Elongated holes are cut in the plate of the front transom for

the ends of the piston rods of the hydraulic buffers; and strengthening plates with india-rubber-pads are attached to the front of the transom, the nuts striking them on recoil.

## 11″ R.M.L. of 25 Tons Slide, "Temeraire" Type.*

11″ R.M.L. of 25 tons slide, Mark I, "Téméraire" type. L. of C., § 2691.

The sides of this slide are built up of plate and tee iron to form girders 18″ deep by 6½″ wide in the flange.

The slide is fitted for the bow compressor, with the compressor bars on the inside of each side.

It is also fitted with running in and out and training gear.

In the former the spur wheels on the chain wheel shaft are inside the girders, and the power passes to each of them from a pinion on the winch handle spindle through two pairs of wheels and pinions on intermediate spindles; this arrangement considerably increasing the gain of power as compared with that of the 10″ slides.

In the training gear, in order to increase the gain of power, the crown wheel (of metal) is not placed on the training shaft, but upon a spindle above it, while a pinion on the spindle gears into a metal bevel wheel upon the end of the shaft.

The brake of the rear racer is the same as that for the 10″ "Temeraire," but the levers are 3′ 6″ long, and are bent to clear the winch handles.

L. of B., § 3014.

The position of the hydraulic buffers is the reverse of that usually adopted, the cylinders being attached to the head of the slide, and the piston made to pull out on recoil: to admit of the gun recoiling to the full extent, a slip of 15″ is given on the rods. The buffers are 4″ in internal diameter, and the holes in the pistons are ·3″.

A movable platform, for use in working the racer brakes is attached in rear, and also a firing platform with a side step.

A pointer made to act also as a guard for the rear roller is fitted on each side.

## 12″ R.M.L. of 25 Tons Slides "Belleisle" Type.

12″ R.M.L. of 25 tons slide, for "Belleisle" and "Orion."

These slides, built by the Elswick Ordnance Company for the "Belleisle" and "Orion" are of the same general construction as slides for 10″ guns.

Their sides have been strengthened by wrought-iron plates bolted to the webs of the girders.

They are fitted for the bow compressor, and the training and the running in and out gears are similarly arranged to those of the 9″ "Sultan" slides.

Both front and rear rollers are grooved, and brakes to act on the rib of the rear racer are fitted as in 10″ slides of the "Temeraire" type.

They are also fitted with hydraulic buffers, 6″ in internal diameter, and having ·45″ holes in their pistons.

The front buffer to receive the carriage when run out consists

* This slide is also suitable for the "Alexandra."

of a wood block with three spindles, on each of which are strung six india-rubber rings, thin plates of iron with holes for the spindles separating each pair of rings; the rear buffer is similar, but has four spindles, each with nine india-rubber rings.

## Slides in Turrets.

Slides in turrets.

The slides for turret carriages are fixtures or parts of the turret; the sides are formed of two upright plates with a piece of tee iron riveted between them at top, the flange of which forms the bearing surface for the carriage, and at the bottom they are connected to the deck by angle iron.

In the "Devastation," as mentioned, page 377, the hydraulic lift for the carriage is part of the turret, and there are two rams; the cisterns with pumps, for these rams are bolted, one to the front and the other to the rear on the inside of the outer side of the slide, their spindles passing through the side and worked in the usual manner. An arrangement, however, is added by which both pumps can be made to act simultaneously upon either ram, and thus decrease the labour of lifting. The arrangement consists in placing on the slide, midway between the cisterns, a valve case with suitable valves and connecting pipes.

Two pipes on each side run into the lower part of the case, through the outer one the water comes from the pump in one of the cisterns, the inner pipe leading to one of the rams. The pipes from the cisterns are always open, those to the rams can each be closed by a screw plug, and these plugs have small pinions on them which gear into each other, so that when one plug is unscrewed to open the passage to one ram, the other plug is screwed home and closes the passage to the other ram.

Thus, when the pumps are worked to give pressure to one ram the pressure is cut off from the other, and whenever the pumps are worked, the pressure passes to one ram or the other, providing only the lowering plug is home; this is in the upper part of the case, and has a pipe from it to each cistern and one down to the pressure pipes in the lower part of the case; when the plug is unscrewed the water can return to both cisterns, when screwed home to neither. If one pump only is used to raise a ram, the effect as regards the other pump is merely to transmit the pressure as far as its outlet valve, but no further.

The running in and out gear is worked outside the turret by several winch handles, in order to admit of a sufficient number of men being employed; while by means of a clutch the shaft of the gear of one slide may be connected with that of the other, so that if necessary the winch handles at both sides of the turret (*i.e.*, of both slides) may be applied to run in the same carriage.

Two hydraulic buffers have been fitted underneath each carriage with the piston rods in tension during recoil. The cylinders lie underneath the front of the carriage, and are supported on two metal brackets on the floor of the turret, to which they are secured by wrought-iron holding down bands. The front cap of each buffer is

connected with the wall of the turret by a wrought-iron tie rod 1·5″ in diameter, one end of which screws into the cap, the other being secured to the wall by two nuts. The piston has four holes, 1″ in diameter. The packing of the piston rod consists of a U leather ring with two metal rings, and cotton rope packing with a metal screw gland. There is a hollow metal plug screwed into the front cap, into which one end of a copper pipe is screwed; the other end is screwed into a run-off cock, which is secured to the turret by a wrought iron plate, with screws. A wrought iron bracket to hold a drip pan for the run-off cock is attached to the turret underneath, and a bracket to hold the drip pan for the gland is attached to the front metal supporting bracket. Both drip pans are No. 5.

Similar buffers have been fitted for the 35 ton carriages of the "Thunderer."

## CHAPTER IV.—MOUNTING FOR B.L. GUNS.

The following are the naval mountings for B.L. guns:—

| Nature. | Weight. | Tonnage. |
|---|---|---|
| | cwts. | tons. |
| 6″ Armstrong carriage .. .. .. .. .. | 23¼ | ·955 |
| „ slide .. .. .. .. .. | 35¼ | 2·356 |
| Vavasseur mountings Broadside | | |
| 4″ Carriage Mark II. .. .. .. .. .. | 7 | ·443 |
| Slide „ II. .. .. .. .. .. | 21½ | 1·291 |
| 5″ Carriage „ I. .. .. .. .. .. | 11½ | ·791 |
| Slide „ I. .. .. .. .. .. | 27¾ | 2·452 |
| 5″ Carriage „ II. .. .. .. .. .. | 11½ | — |
| Slide „ II. .. .. .. .. .. | 26 | — |
| 6″ Carriage .. .. .. .. .. .. | 23¼ | 1·141 |
| Slide .. .. .. .. .. .. .. | 37¾ | 3·452 |
| 8″ Carriage .. .. .. .. .. .. | 45½ | — |
| Slide .. .. .. .. .. .. .. | 74 | — |
| Central pivot Mountings | | |
| 4″ Carriage .. .. .. .. .. .. | 8¼ | — |
| Slide .. .. .. .. .. .. .. | 13½ | — |
| 5″ Carriage .. .. .. .. .. .. | 12 | — |
| Slide .. .. .. .. .. .. .. | 19¼ | — |
| 6″ Carriage .. .. .. .. .. .. | 22¼ | — |
| Slide .. .. .. .. .. .. .. | 45¾ | — |
| 8″ Carriage .. .. .. .. .. .. | 38 | — |
| Slide .. .. .. .. .. .. .. | 77¾ | — |

### 6″ B.L. Armstrong Carriage and Slide.

Carriage, Fig. 124. § 4058.

The brackets consist of steel plates riveted to a wrought iron frame. Each bracket is fitted with three wrought iron grooved rollers, having steel axles, a gunmetal breeching bush near the front, a capsquare of gunmetal, and a P.B. trunnion bearing.

The rollers are grooved to fit V shaped ribs on the slide, and are lubricated by means of holes drilled through the axles.

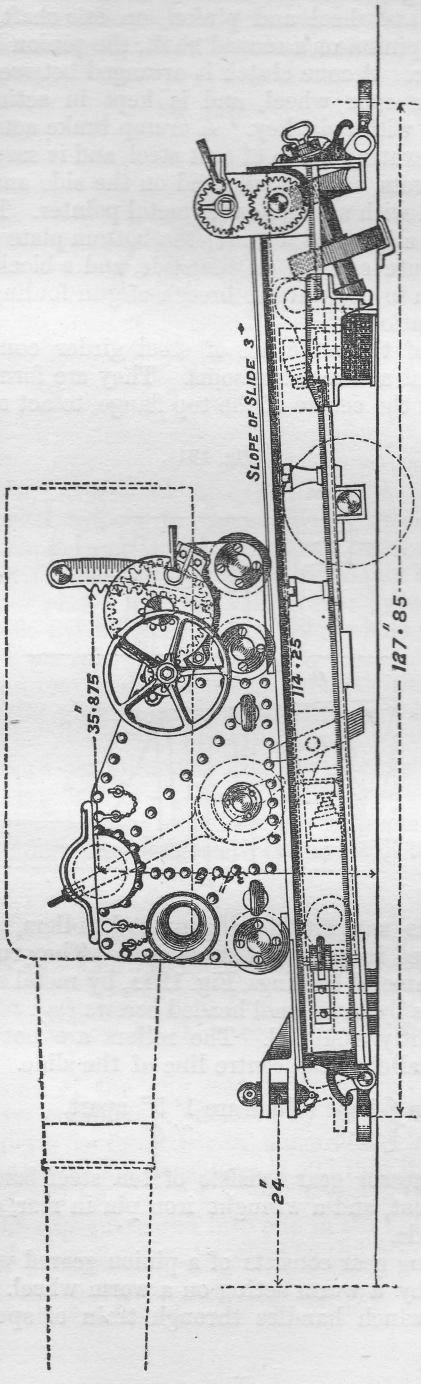



Fig. 124

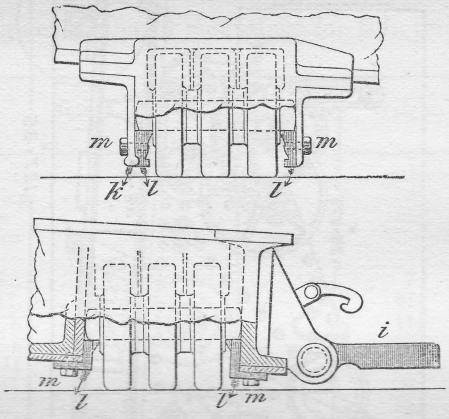
The compressor gear is similar to that on the 64-pr. R.M.L. carriage, Mark V. There are 11 hanging plates.

The elevating gear is fitted on the left side of the carriage. It consists of a handwheel and pinion, on one shaft, driving a spur wheel and steel pinion on a second shaft, the pinion being geared to the elevating arc. A cone clutch is arranged between the elevating spindle and the spur wheel, and is kept in action by a spring washer and nut, with split key. A cramp brake acts upon the spur wheel. The elevating arc is of cast steel, and is secured to the gun by two steel pivots. It is graduated on the side and back, and the carriage is fitted with an adjustable metal pointer. The carriage has front and rear clips bolted under the bottom plate; also a stop to act against volute springs on the slide, and a block of wood inside the rear transom to prevent the breech of gun fouling the slide gear at extreme elevation.

The slide.

The sides of the slide are of steel girder connected by cross plates, and front and rear transoms. They are formed each with a V shaped rib on the centre of the top flange, to act as a guide to the carriage rollers.

Fig. 124A.




§ 4312.

The slide is supported on gunmetal rollers, permanently in action: arranged in groups of three each. They run on steel axles, secured in gunmetal bearings, Fig. 124A, by metal stops (*l*) retained under the axles by hexagonal headed screws (*m*). The ends of the axles are slightly rounded. The rollers are not radial, but have their axles parallel to the centre line of the slide.

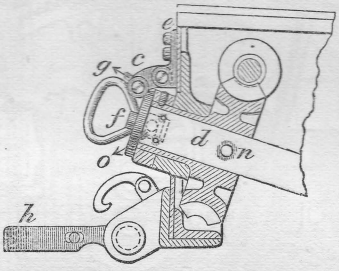
The centres of the { front rollers are 1′ 5″ apart. / rear „ 3′ 6″ „

The compressor gear consists of ten steel bars supported on a steel pin in front, and a wrought iron pin in rear, and has a tripper on the right side.

The training gear consists of a pinion geared with a rack in the deck, driven by a worm acting on a worm wheel. Power is transmitted from winch handles through train of spur gear, held in

vertical guards at the rear of the slide, to the worm shaft. The winch handles are secured on their shafts by set screws. The winch handle pinions are controlled by cramp brakes. The deck pinion is taken out of gear with the rack by drawing the shaft and pinion to the rear, and there securing them by a link and key. The training

Fig. 124B.




shaft (*d*) Fig. 124B, has a metal cap (*f*) with two handles, which can revolve freely with respect to the shaft. A wrought iron pin (*g*) attached by a chain and loop to the rear transom, when passed through the link (*c*) and the lugs in the cap retain the deck pinion in gear. The deck pinion is scured out of gear by withdrawing the shaft until the hole (*n*) is in line with a similar hole in the collar (*o*) and inserting the pin (*g*).

The front and rear stops consist of wrought iron knees secured to the web of the girders, each supporting a volute spring and spindle.

The front loops are jointed to fold towards the front, when not required, by the removal of a pin.

A pointer is fixed to the outside of the gunmetal bearing of the rear roller on the left side to indicate the angle of training.

## Broadside Mountings.

### B.L. 4″ of 13 and 22 cwt. Carriage and Slide. Mark II.

This carriage, Figs. 125, 126, is formed by a single metal casting. consisting of two hollow brackets connected in front by a hollow transom.

The trunnions of the gun rest in trunnion bearings in the brackets, and are completely enclosed by metal capsquares; each trunnion capsquare is formed with flanges which fit in undercut slots in the brackets, the capsquare is slid into its place from the outside, and secured by a steel key which passes through a hole in the flange of the capsquare and into one in the bracket. This key is at the end of a brass chain, attached to the capsquare by a split pin.

The under surface of the brackets are planed; they slide, during

recoil, upon the upper surface of the sides of the slide. To retain the carriage in position on the slide, a clip is formed underneath each bracket on the inside, running its whole length: clips are also

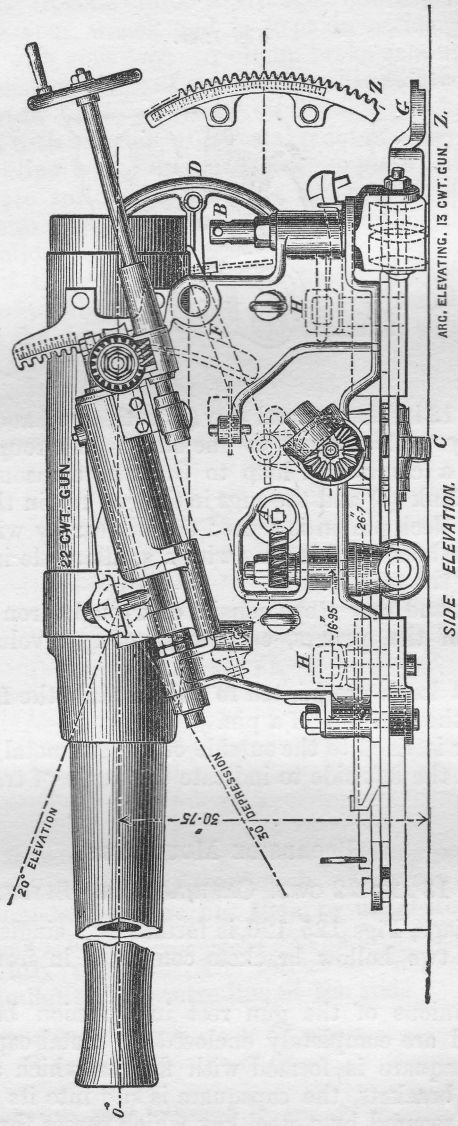
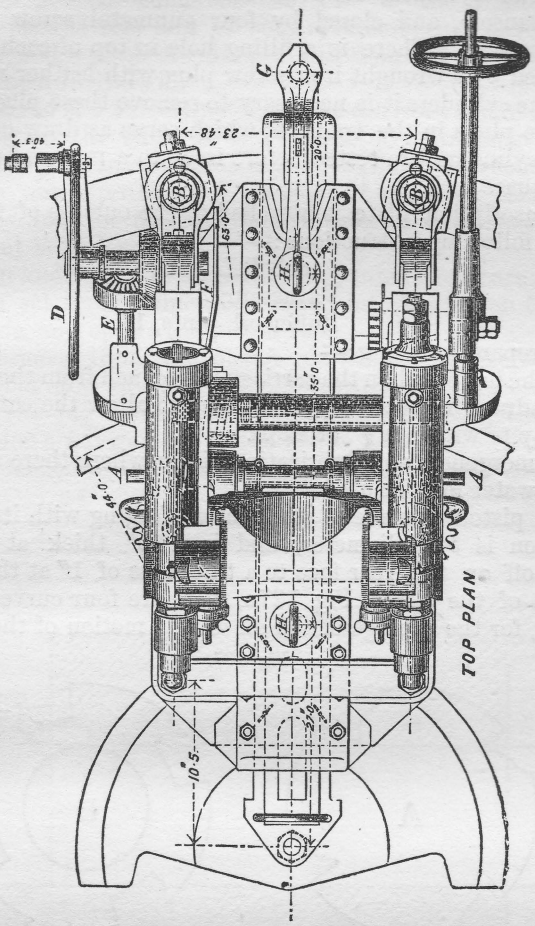



Fig. 125.

Fig. 126.




formed front and rear on the outside. These clip the upper flanges of the side frames of the slide.

A loop is formed on the outside of each bracket, and there is also a third loop under the transom. These form part of the casting.

Each bracket forms the cylinder of a hydraulic buffer. A piston and piston rod works in each cylinder, the front ends of the piston rods being attached to the front of the slide. The piston rods are therefore in tension during recoil.

The cylinders are closed in rear by screw caps. In each cap there is a recess in which a gutta-percha washer is laid, which when the cap is screwed home enters a corresponding recess in the end of the cylinder, and makes the joint tight. There are slots on the outer face of the cap to facilitate screwing it home.

The cap for the right hand cylinder is of metal, that for the left

of wrought iron, and has a screwed spindle projecting from its rear face, for the attachment of the elevating bracket.

The two cylinders are connected by passages which are drilled in the transom, and closed by four gunmetal screw plugs with leather washers. There is a filling hole in top of each cylinder in rear, closed by a wrought iron screw plug with leather washer. To empty the cylinders it is necessary to remove these plugs, and also one of the plugs in the transom, which serve as draw-off cocks.

The cylinders are tested before issue to a pressure of 1,500 lbs. on the square inch.

An inscription plate is attached to the outside of the cylinder with the following instructions :—

4 inch B.L. gun.
Vavasseur.
Buffer oil, pints, 14.

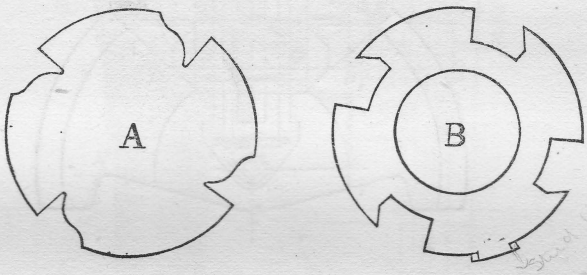
To prepare for firing :—

Fill the buffer, when the carriage is one inch from the front stops, and withdraw, if necessary, sufficient to allow the carriage to run out gently to within a $\frac{1}{4}$″ of stops.

On emergency any lubricating oil, or where there is no danger of frost, water may be used.

Each piston is made of steel, in one forging with its piston rod. The piston is 5·1″ diameter, and is 1·25″ thick at the centre, beveled off on the rear face to a thickness of 1″ at the edge. In the edge of the piston, Fig. 127A, there are four curved grooves or openings, for the passage of the oil during motion of the carriage.

Fig. 127.




A metal ring 1″ thick and 5·1″ diameter, called a rotating valve, Fig. 127B, fits on the piston rod, just in front of the piston. This ring can turn freely round the rod, but cannot move along it, being kept in its place by a wrought iron nut screwed on the piston rod and secured by a pin. There are four grooves on the edge of the valve, differing in form from those on the piston. There is also a stud or projection on the edge of valve ·15″ deep and ·75″ wide, which works in a spiral groove in the cylinder. As the gun recoils and the carriage moves back over the piston rod, the valve is forced to rotate. The piston is prevented from rotating with the valve by its attachment to the slide, and thus the area of the openings for the passage of the oil is continually varying during recoil. The piston is adjusted so that the rotation of the valve may, at the commencement of the motion, slightly increase the area of the openings, and afterwards gradually diminish it to the end of the recoil.

The piston is set so as to completely close the valve at 12″ recoil. This gives a recoil of about 10¼″ in practice.

The spiral grooves commence at 1·2″ to the right of the vertical line on the rear face of both cylinders, they have a right handed twist, and a pitch of rifling of 1 in 8 on the circumference, equal to one turn in 128·17″.

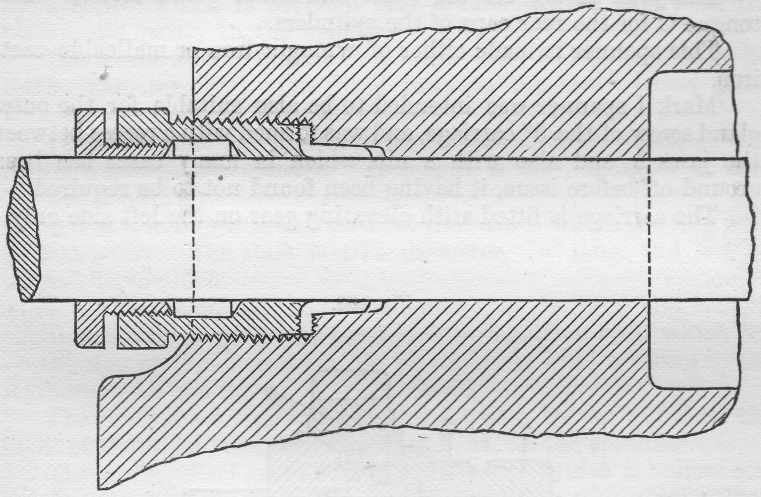
The piston rod is 2·25″ diameter, but at the front where it passes through a lug on the slide, it is 2″ diameter. The length of the bearing for the rod in the slide is 3·5″. The rod is secured by a wrought iron nut screwed on it in front of the lug. The screw thread on the rod for this nut is 2·5″ long, six threads to the inch. The nut is 2″ long.

The piston and rod were originally prevented from turning by a wrought iron set screw, which is screwed into the lug on the slide from the inside, and enters the piston rod.

Since February 1885, the piston rod has been prevented from turning by a flat steel key, dovetailed vertically into a recess on the rear face of the lug and secured by a small set screw; the end of the key entering a keyway cut in the piston rod.

The total length of the piston rod is 32·05.″

Fig. 128.



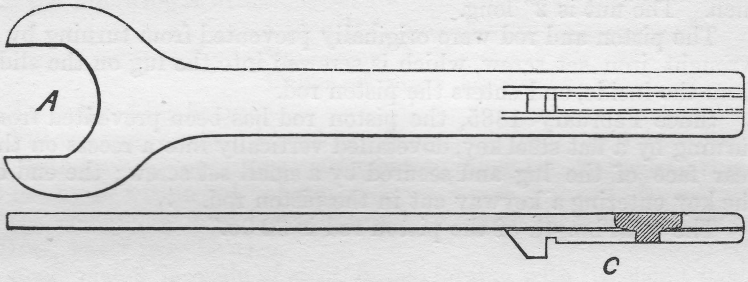
In the front end of each cylinder, a stuffing box, Fig. 128, is formed, through which the piston rod passes. A leather packing ring greased with tallow is placed in the end of the stuffing box with its rim resting on a shoulder of the box. It is kept firmly down, on this shoulder by an inner screw gland of metal, which screws into the stuffing box. In a recess in the gland the packing is placed.

The packing consists of cotton twisted into three plaits of five strands each. It is saturated with tallow, bound at the end, about

seven turns taken round the piston rod, and forced tightly into the recess in the inner gland. A metal outer gland is then screwed down on the packing till its rim comes to within $\frac{5}{16}$″ of the rim of the inner gland.

§ 5137. A spanner, Fig. 129, is issued for the glands and caps. This is spanner, hydraulic buffer, No. 9, Mark II, gland and cap, Vavasseur's, B.L. 5″ and 4″.

Fig. 129.



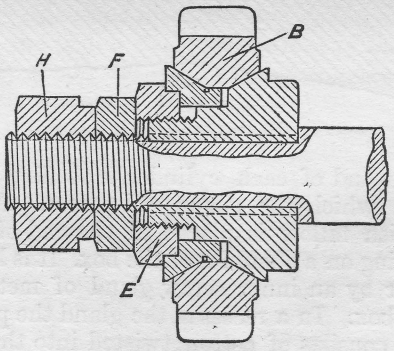

The jaws A are for the outer and inner gland screws. The tongue C for the rear caps of the cylinders.

This spanner is made either of wrought-iron or malleable cast-iron.

Mark I spanner was intended to be also suitable for the outer gland screw of the 5″ carriage, and was formed with a recess between the jaws A, and also with a nib, which in many cases has been ground off before issue, it having been found not to be required.

Elevating gear. Fig. 130. The carriage is fitted with elevating gear on the left side only.

Fig. 130.



The gear consists of:—

An arc.
A pinion with spindle.
A bracket, spindle pinion, elevating.
A worm wheel, with two friction cones.
A sliding worm spindle, with handwheel and worm.

The arc is of forged steel, and is rigidly attached to the gun The arc for the 22 cwt. gun has teeth on its face, that for the 13 cwt. has teeth on the back. Radius of the pitch for the 22 cwt. 25·72″, for the 13 cwt. 21·9″. Both arcs are graduated in degrees from 20° elevation to 30° depression. Smaller graduations on the arcs read to invervals of 10′.

The elevating bracket consists of a single metal casting, containing bearings both for the pinion spindle and the worm spindle. It is secured on the shank of the cylinder cap by a wrought-iron nut; it is also attached to the left bracket of the carriage by two screws on the outside.

The spindle is of steel 1·5″ diameter and 6·7″ long. It rests in its bearing in the elevating bracket.

The pinion is of steel, 12 teeth, radius 3·82″; it gears with the teeth of the arc, and is secured on the inside end of the spindle by a screw, which is screwed into a hole drilled partly in the pinion and partly in the spindle.

The worm wheel consists of a metal band B, Fig. 130, with 24 teeth, diameter 5·3″. The band rests on the two friction cones which fit on the spindle inside it.

The inner cone has two feathers on the interior, which fit into featherways on the spindle. It length is ·55″, diameter at base 3·4″, at head 2·75″.

It has a hollow screwed stalk, at the base of which is a ring with a featherway. The stalk is 1·75 diameter, ·75″ long, and has 10 threads to the inch.

The outer cone is the same diameter at the head and base as the inner, it is ·5″ long, and has a hollow projection on it which fits on the ring on the inner, a feather on the outer cone working in the featherway on the inner.

The cones are forced into the worm wheel, by one nut E on the stalk of the inner cone, and two nuts F, H, on the spindle.

The worm wheel gears with a metal worm, which is hollow and fits on the spindle, a feather on the worm working in a long featherway in the spindle. The worm must, therefore, turn with the spindle, but can slide freely along it. The worm is kept in gear with the worm wheel by the elevating bracket, which partly surrounds it. The worm spindle passes through the bracket, and it is held in a bearing attached to the slide. On recoil the elevating bracket slides along the spindle, carrying the worm with it.

The worm spindle is of steel 1·5″ diameter and 38·25″ long. It is retained in its bearings by two collars, one screwed on the front end, the other pinned either in front or rear of the bearing according

as the shaft is secured for housing or action. The securing pin is attached to the collar by a brass chain.

A handwheel is secured on the end of the shaft, a featherway in the wheel fitting on feather on shaft. The wheel is 12″ in diameter. Its rim is of seamless brass tube 1″ bore, and $\frac{1}{16}$″ thick, it has four metal radial arms and a wrought-iron handle. The arms are riveted to the rim by four brass rivets.

A metal pointer is fixed by an iron bolt and nut to the elevating bracket for the 22 cwt. gun; the same pointer is fixed for the 13 cwt. gun to a metal bracket secured by a screw on the elevating bracket.

§ 4648. The introduction of the automatic clamp for tangent sight has necessitated a slight alteration to the recess of the elevating arc, which consists in widening it $\frac{1}{2}$″.

Inscription plate. A metal inscription plate is attached to the right cylinder at the rear, on which is marked the nature, pattern, date and register number of the carriage.

The appurtenances for the carriage are:—

One measure, tin, hydraulic buffer filling, page 342, to every six or less number of carriages.

One spanner, hydraulic buffer, No. 7, p. 472 } To each
Do. do. 9, p. 408 } mounting.

One spanner for elevating gear.

The last-named is a double-ended steel spanner of the ordinary type, 12″ long.

Slide. The slide, Figs. 125, 126, consists of two side frames connected by three transoms.

The side frames are cast steel girders; planed on their upper surfaces, which have a slope of 15°.

At the front end of each frame there is a lug to which the front end of the piston rod of the carriage on that side is secured. The lug is 3·75″ thick, and has a hole through it 2·05″ diameter, recessed at the rear end. Two recesses are planed across the upper flange. In rear of the lug there is an oil cavity. A passage is made into this cavity from the outside of the frame, and is closed by a P.B. screw plug.

Two of the transoms are wrought-iron plates, riveted underneath the side frames in front and rear.

The third transom is an angle plate attached to the front of the slide by rivets and two vertical bolts. This transom has two indentations in it, which are intended to serve as fulcra for a lever used to release the front drop pin.

The slide is fitted with four metal rollers. The front rollers are 6″ diameter and 3·95″ broad. Their axles are of steel, 2″ diameter, secured in swivels by a nut and split key.

The swivels are of steel or malleable cast-iron; each consists of a flanged foot, with a shank. A feather on the axle fits in a feather way in the bearing, and prevents the axle turning with the roller. The shank of the front swivel passes through a vertical hole in the side frame, which leads into an opening, *vide* Fig. 125, formed in the casting.

A worm quadrant of metal or of cast steel is secured in this opening on the top of the shank of the swivel, by a nut and split key. A featherway in the quadrant fits a feather on the shank. Number of teeth in the quadrant 8, radius 4″.

The quadrants gear, with right and left-handed threads on a cross horizontal worm shaft A of wrought-iron, which rests in bearings in bosses, on the inside of the side frames. The shaft is secured by a distance collar of metal which fits over it, for its whole length between the frames, and prevents any lateral motion.

The distance collar is formed in two pieces which are secured together by screws.

The ends A of the worm shaft are square to take a winch handle. The position of the rollers can be changed as desired for traversing, running in or transporting, by turning the worm shaft. The slide does not rest on its front rollers in action.

Rear rollers.

The rear rollers are also 6″ diameter; and are each in two parts, each part 2·65″ wide, Their axles are steel, and are secured in swivels of steel or malleable cast-iron. The swivels are similar to those for the front rollers, but the axles are supported in the flanged feet in three places, and the lower part of the swivel forms a guard for the rollers. The shank passes through a vertical hole in the rear of the side frame, and is secured by a nut. A steel capstan head B is secured on the shank, a feather on the capstan fitting in a featherway in the shank.

The capstan head has two holes right through the top; by means of a lever placed in these holes, the position of the rear rollers can be altered as desired, for training, traversing, running in or transporting.

Each roller is secured in position for training or running in, by a wrought-iron stop, which passes through holes in the side frame, and the swivels.

These stops are attached by thongs to eyelets screwed into the rear of the side frames.

Pivot.

The slide is pivoted for action to a real pivot on the deck by a pivoting bar. The pivoting bar is of wrought-iron 68″ long, towards the front end of the bar there is a projection in which there are three holes, the two in front elongated, and the rear ones circular. In the extreme front of the bar there is a circular hole 1·713″ diameter. The bar has a wrought-iron lifting handle at the front.

The rear end of the bar is forked, and there is a hole in it 3·013″ diameter. The pivoting bar can slide on the transoms of the slide, in guides, fixed over each transom. The front guide is steel, it is attached to the transoms by 12 bolts, ·8″ diameter.

The rear guide is steel or M.C.I., and is riveted over the rear transom.

For action the pivoting bar is secured to the slide by drop pins H, which pass through holes in the guides, the bar, and the transom.

Underneath the transoms there are front and rear guides for a traversing bar.

The front guide is a steel plate riveted to the transom and side

frames, and also attached to the frames by the vertical bolts securing the angle iron cross bar. The front of the guide is curved and forms a hook, which clips a pivot plate fixed to the deck, and resists the tendency of the slide to jump during the recoil.

The rear guide of the traversing bar is in two parts of steel or M.C.I., riveted underneath the rear transom.

The traversing bar is of wrought-iron, 54·1″ long, forked at the front end and recessed at the rear.

The drop pins H, which secure the pivoting bar to the slide when in action, also enter holes in the traversing bar, and secure it. Diameter of front hole in traversing bar 2″, of rear 3″.

A metal flap G is hinged to the rear end of the traversing bar. This flap is of a special pattern for H.M.S. "Audacious," having two projections on the under side, one on each side of the hole for the pivot. The traversing bar has also an additional hole.

The front drop pin is of cast steel with a loop head.

The rear drop pin is also of steel either cast or forged, with a loop head, and long handle; on this handle the metal flap is secured in action by a cotter of steel or metal, which is attached by a thong to a screw loop on the head of the pin.

Training gear. The training gear consists of a pinion, C, which gears with a fixed rack upon the deck and is turned by a worm on a horizontal shaft, itself turned by a hand wheel, D, on the outside of the right bracket, through a train of beveled wheels.

The deck pinion C is of cast steel or metal. It has 16 teeth, diameter 7·63″. The teeth are set at an angle of 3°; the front face of pinion is stamped with word *front*. The pinion has a long boss projecting from each face.

The spindle of the pinion is of steel 2″ diameter. It is secured by a nut and split key in a swivelling bracket of metal. The upper part of the bracket forms a long bush, which fits over the worm shaft; and the ends of which pass through the side frames.

A wrought-iron lever F is attached by an iron clamp bolted to the upper part of the swivelling bracket on the right side. By raising or lowering the end of the lever, which projects to the rear of the slide, the bracket can be turned and the pinion put in or out of gear with the rack on the deck. To admit of this motion of the pinion, the teeth in the rack, at one point are elongated.

The pinion is secured in or out of gear, by a metal clamping nut, with two short arms, fitting on the clamp bolt, which projects from the lever through a slot in the side of the frame.

The worm shaft is of steel or wrought-iron; it rests in the ewivelling bracket.

A worm, of cast or wrought steel, or M.C.I., or metal, fits on the shaft, a feather on the shaft entering a featherway in the worm. Length of worm, 4″.

On each end of the worm shaft a mitre wheel of cast steel, 14 teeth, 5″ diameter, is secured by a washer, nut, and pin. The wheel on the right side of the slide gears with a bevel wheel on a diagonal shaft E, held in bearings fixed to the side frame.

At the upper end of the shaft E there is a bevel wheel gearing with another bevel wheel, on the spindle of which is a hand wheel D. The bearings for the shaft form covers for the two pairs of wheels. The lower cover has a boss projecting into the hole in the side frame, in which it rests, and forms a bearing for the swivelling bracket to turn in. These covers are secured by the mitre wheels on the ends of the worm shaft, and are prevented from turning by steady pins fixed on the side of the slide.

The diagonal shaft is of steel, 16·7″ long and 1·6″ diameter, with a keyway along its length for key securing the mitre wheel. A collar is secured on the shaft by a pin, just above the lower metal cover.

The mitre wheel on the spindle of the hand wheel D is of metal or of M.C.I., 14 teeth, and is made with a long boss, over which a collar is either driven tightly, or else cast as part of the boss. A steel feather is fixed on the outside of the boss by two screwed studs riveted over. This feather may also form part of the casting.

The handwheel spindle is 13·1″ long, 1·5″ diameter, it passes through a metal bushed hole in the side frame, the upper metal cover is secured on it, and is also secured by two studs projecting from the side frame. The boss of the mitre wheel is placed on the spindle and can revolve freely round it.

The hand wheel D is cast steel. or metal, or M.C.I. It has a handle secured by a cotter in a boss in one of the arms of the wheel. This cotter is attached by a leather thong to a hole in the arm, as is also the split key securing the wheel.

The handle consists of an iron spindle 18·3″ long, round which a wood quill is secured by a nut on the spindle. The wood has a brass ferule at the end.

Similar gear was originally fitted on both sides of the slide, but at present only the lower pair of mitre wheels and their cover are retained on the left side.

Fittings. A metal bracket to receive the end of the sliding worm spindle is bolted to the left side.

Two loops of iron on each side.

Two iron hooks riveted to right side for iron handspike.

One hook, left side, for winch handle.

A metal bracket is fixed on the outside of right side for tube box by two bolts.

A metal bracket is fixed by two screws to the rear of the right side for extractor.

A metal bracket for vent rimer is fixed by three screws to right side.

A metal inscription plate, fixed by two screws to right side, gives the nature, mark, register No., date of manufacture, and nominal weight of the slide.

An eyelet is screwed into the rear of each side. To these are attached the thongs carrying the stops for securing the rear roller swivels.

A buffer is fixed on the inside of each side frame at the front.

It consists of an iron spindle with head carrying a ring of india-rubber. The spindle passes through a hole in a projection on the slide, and is secured by a key.

A metal retaining pawl is pivoted on the end of a short bar screwed into the left side near the front.

The pawl is secured on the bar by a washer and pin. The rear end of the pawl, when raised, abuts against the side of the carriage and prevents any motion. The pawl is kept in action by a stop with a bent handle which passes through a hole in the side, and on which the pawl rests. Withdrawing the stop allows the pawl to fall and releases the carriage. The stop is attached to the frame by a chain.

An iron (for future manufacture, steel) handspike, 33″ long, with a hook at one end, a winch handle, and a No. 9 spanner, are issued with each mounting.

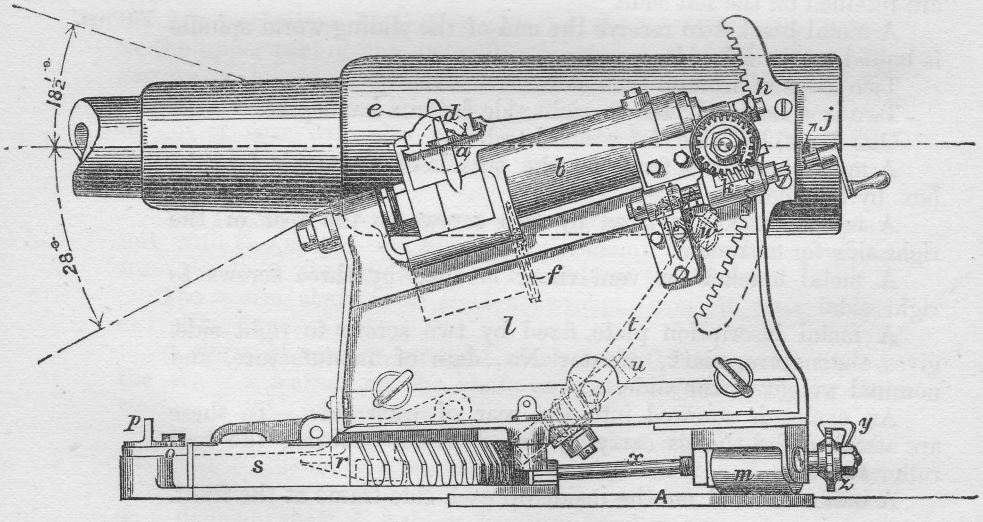
A McMahon's spanner, 21″, is issued with every two or less number of mountings.

### 4″ B.L. of 22 cwt. Carriage and Slide. Mark I.

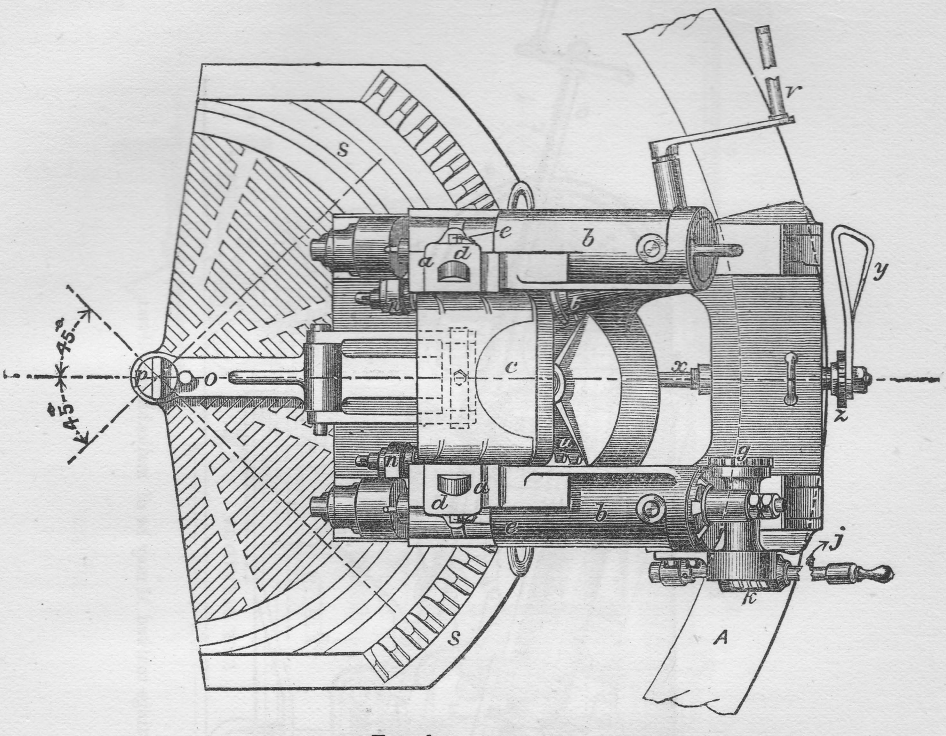
§ 4168. Mark I carriage and slide, Fig. 131, were manufactured for the "Swiftsure," and are generally similar to the preceding. The slide was not fitted with front rollers, and the rear rollers were each in one piece. The training gear consisted of a toothed pinion *u*, gearing into a rack cast on the pivot plate *s*, and itself driven by a worm on the shaft *t*. The power from the winch handle *v*, outside the right bracket is transmitted to the shaft by two metal worm wheels.

The clamping arrangement consists of a screw *x* working in a nut in the rear block plate, which is pressed against the back of

Fig. 131.




Side elevation.




Top plan.

the pivot plate *s*. Motion is given to the screw by a ratchet wheel *z* and lever handle *y*.

The pivot bar *o* is of steel and is attached to the slide by two bolts. The pivot plug *p* is of gunmetal, and passes through the pivot bar into a socket in the pivot plate *s*.

The pivot plate *s* is of gunmetal, cast with a racer, a hook racer for hook *r* on front of the slide, and a rack for the training pinion *u*.

The sweep plate A is of gunmetal, 7″ wide and 1″ thick.

§ 4564. R.C.D. photo-litho. 159.

### 5″ B.L. Carriage and Slide. Mark I.

The carriage, Figs. 132, 133, consists of a gunmetal casting forming two buffer cylinders A, connected by a hollow transom, and is generally similar to that for the 4″.

Oil channels are formed in the ends of the brackets for lubricating the upper surfaces of the side frames.

Two projections are formed on the rear end of the left bracket, to which the elevating gear is attached. Both the cylinders are closed in rear by metal screw caps, interchangeable with that of the right hand cylinder in the 4″; in each the joint is made secure by a washer of gutta-percha. Like the 4″, the cylinders are tested before issue to a pressure of 1,500 lbs. on the inch.

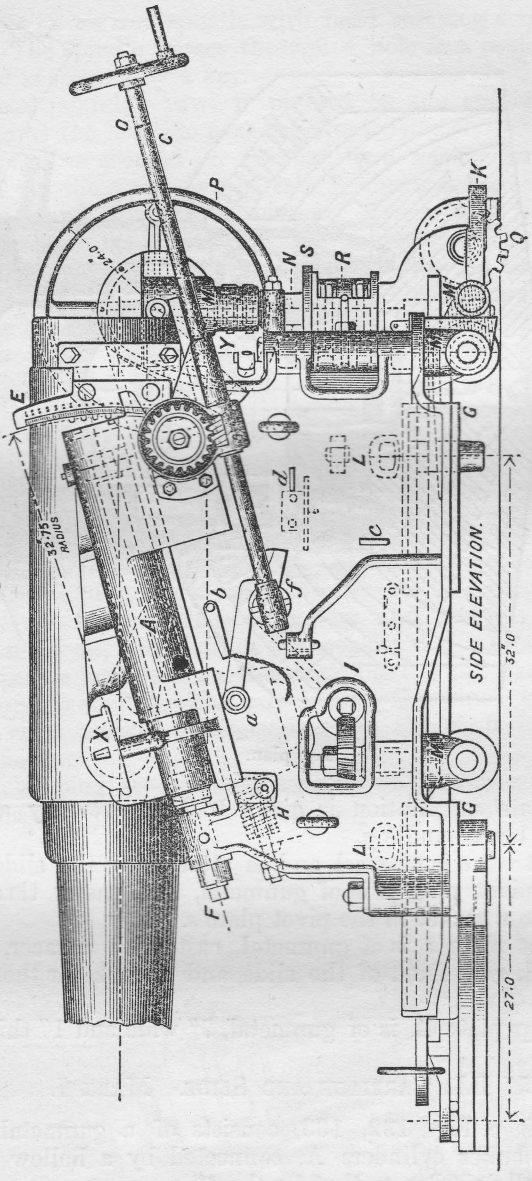



Fig. 132.

The filling hole plugs are of P.B. They have air passages for admitting the air into the cylinders, when partially unscrewed.

An inscription plate is attached to the outside of right cylinder in rear, with the following instructions:—

5″ B.L. Gun.
Vavasseur.
Buffer oil; pints, 24½.

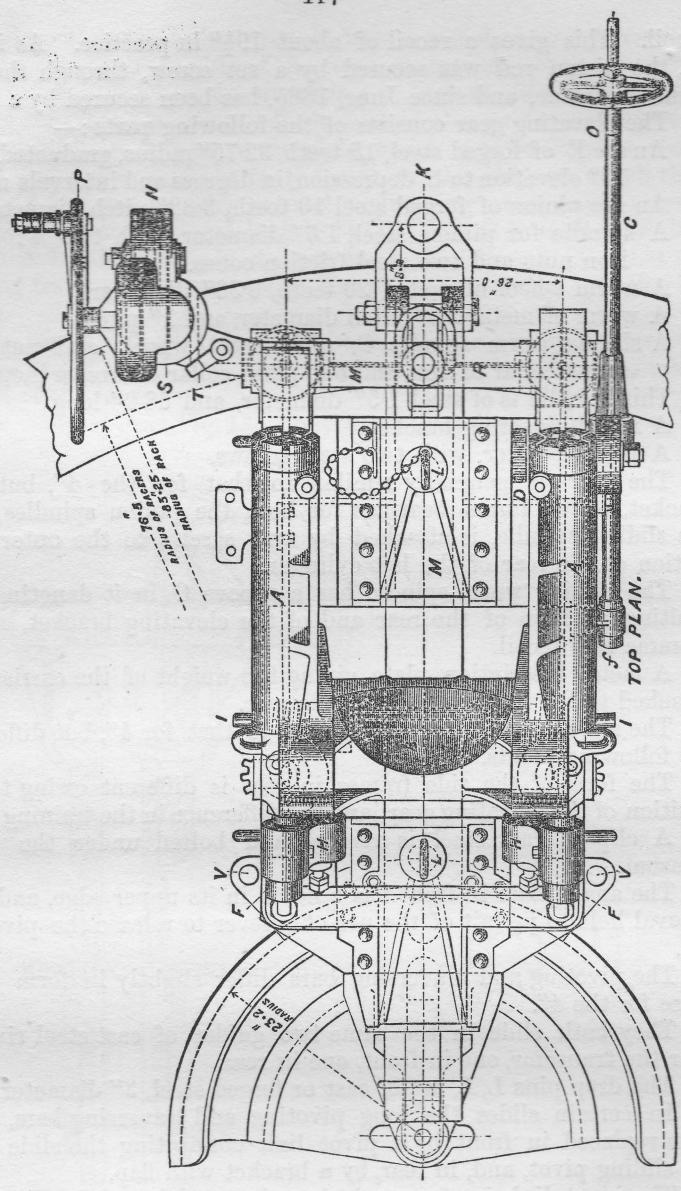



Fig. 133.

To prepare for firing :—

Fill the buffer, when the carriage is 1″ from the front stops, and withdraw, if necessary, sufficient to allow carriage to run out and gently touch stops.

On emergency, any lubricating oil, or when there is no danger of frost, water, may be used.

The buffers resemble those for the 4″, but there is a slight difference in the form of the outer gland screw. After the cotton packing has been put in, this gland should be screwed home, till only one thread remains outside.

The piston is set so as to completely close the valve at 24·25″

recoil. This gives a recoil of about 19½″ in practice. As in the 4″, the piston rod was secured by a set screw, through the lug, from the inside, and since June, 1885, has been secured by a key.

The elevating gear consists of the following parts :—

An arc E of forged steel, 15 teeth, 32·75″ radius, graduated from 15° elevation to 8° depression, in degrees and intervals of 10′.

An arc pinion of forged steel 10 teeth, 3·82″ pitch diameter.

A spindle for pinion, steel, 1·5″ diameter, with two wrought-iron nuts and two steel friction cones.

A worm wheel of metal, 20 teeth, 6·36″ diameter.

A worm of metal 2·8″ pitch diameter, and 1″ pitch.

A sliding worm spindle C, with hand wheel, and nut, one screw collar of iron, and one plain collar of iron or metal.

This spindle is of steel 1·5″ diameter, and 58·9″ long.

A metal elevating bracket.

A metal pointer, with two steel screws.

The gear is generally similar to that for the 4″, but the bracket, which forms bearings for both the pinion spindles, and the sliding spindle, is attached by two screws to the outer projection at the rear of the left cylinder.

The sliding worm spindle has a groove O, in it denoting the limiting position of the rear end of the elevating bracket, at the extreme safe recoil.

A metal inscription plate, giving the weight of the carriage, is attached to the right cylinder at the rear.

**The slide.**

The slide is also generally similar to that for 4″, but differs in the following points.

The form of the side frames in rear is different owing to the position of the elevating gear, and the difference in the training gear.

A clip of cast steel is riveted and bolted under the front transom.

The angle plate in front has a notch in its upper edge, and also an oval hole to permit of the use of a lever to release the pivoting pin.

The pivoting and traversing bars differ slightly in form from those for the 4″.

They both slide in the same two guides of cast steel riveted over the transoms, one in front, one in rear.

The drop pins L, L, are of cast or forged steel, 3″ diameter.

In certain slides the long pivoting and traversing bars, have been replaced in front by a pivot link connecting the slide with the sliding pivot, and, in rear, by a bracket with flap.

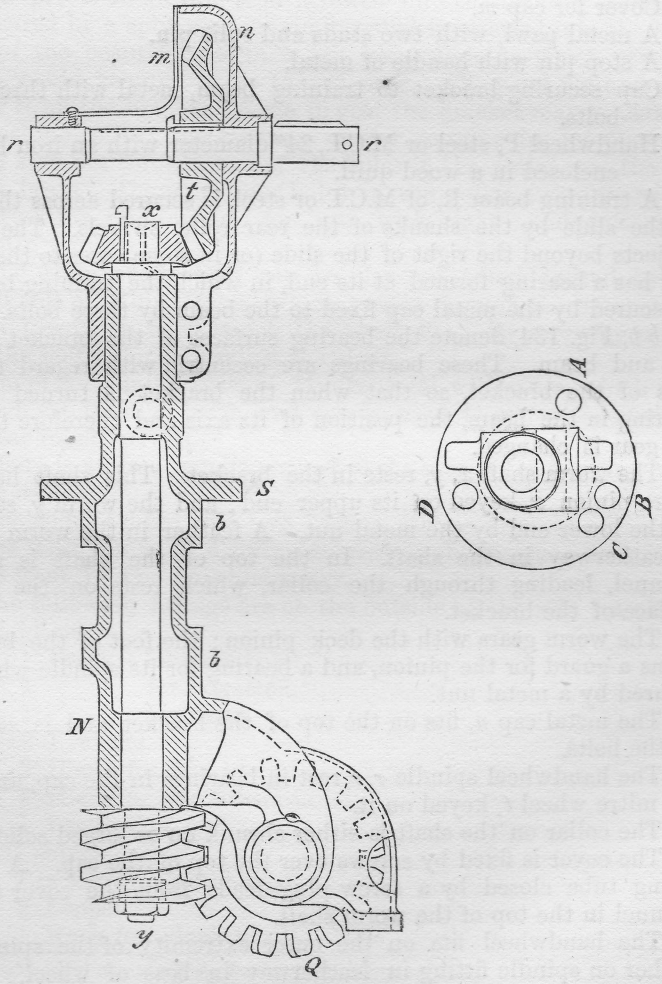
The pivot link is of wrought iron, its total length is 28″, it is formed with a slot in front, which fits over the projection on the sliding pivot, to which it is also connected by two 1″ bolts, which pass through a washer fitted between the end of the link and the sliding pivot, its rear end is connected to the front guide of the slide by the drop-pin. For future manufacture bosses will be formed on the sliding pivot, on which the front of the link will rest, and through which the bolt securing it will pass. For slides which had the long bars originally, two loose washers are placed between the link and the sliding pivot at the position of the bolts.

A plate of gunmetal or wrought-iron is attached by two screws of forged bronze to the side of the front guide to ensure the re-entry of the pivot link when the mounting is trained on side-eye from housing into firing position. Both sides of the guide are prepared with tapped holes to receive the plate, which is to be fitted on that side of the guide suitable to the side of the ship on which the mounting is placed. The bracket connecting rear flap to rear guide is of gunmetal, total length 24·175″. It is connected to the rear guide by the drop-pin, its rear end being formed like that of the long traversing bar to receive the pin on which the rear flap is hinged.

The capstan head Y for the shanks of the rear roller swivel bearings are of metal, and are formed each with two loops to take the end of the lever.

The training gear, Fig. 134, consists of the following parts :— **Training gear.**

Fig. 134.



A worm shaft *x*, *y*, of steel, 1·75″ diameter at bearings, and 29·78″ long.

A worm *y* of metal or M.C.I., pitch 1·5″, diameter 4·5″, with metal nut.

A deck pinion Q, of steel, wrought-iron, metal or M.C.I., 16 teeth, 7·63″ diameter.

Spindle for deck pinion, steel, 2″ in diameter,with metal nut.

Mitre pinion *x*, metal or M.C.I., 14 teeth, 4·9″ diameter, with steel key.

Mitre wheel, *t*, metal or M.C.I., 28 teeth, 9·8″ diameter, with steel key.

Spindle for handwheel *r*, *r*, of steel, 1·5″ diameter at bearings,

A training bracket N, carrying gear, of metal, with a clamping bolt of Muntz metal.

Cap, bearing, wheel, mitre, *n*, of metal, with bolts and nuts of wrought iron or Muntz metal.

Cover for cap *m*.

A metal pawl, with two studs and split pin.

A stop pin with handle of metal.

Cap securing bracket to training beam, metal with three iron bolts.

Handwheel P, steel or M.C.I., 24″ diameter, with an iron handle enclosed in a wood quill.

A training beam R, of M.C.I. or steel, is secured across the rear of the slide by the shanks of the rear roller swivels. The beam projects beyond the right of the slide (or in some cases to the left), and has a bearing formed at its end, in which the training bracket is secured by the metal cap fixed to the beam by three bolts.

*b b*, Fig. 134, denote the bearing surfaces of the bracket in the cap and beam. These bearings are eccentric with regard to the axis of the bracket, so that when the bracket is turned in its bearing in the beam, the position of its axis and therefore that of the gear is changed.

The worm shaft *x*, *y*, rests in the bracket. This shaft has the mitre pinion *x*, keyed on its upper end; and the worm *y*, secured on the lower end by the metal nut. A feather in the worm fits in a featherway in the shaft. In the top of the shaft is an oil channel, leading through the collar, which rests on the upper surface of the bracket.

The worm gears with the deck pinion; the foot of the bracket forms a guard for the pinion, and a bearing for its spindle which is secured by a metal nut.

The metal cap *n*, fits on the top of the bracket, and is secured by the bolts.

The handwheel spindle *r*, *r*, rest in bearings in the cap, and has the mitre wheel *t*, keyed on it.

The collar on the shaft is either shrunk on or forged solid.

The cover is fixed by screws over the top of the cap. A lubricating tube closed by a screw plug leads from the cover to the channel in the top of the worm shaft.

The handwheel fits on the outer extremity of the spindle, a feather on spindle fitting in featherway in boss of wheel. It is

secured by a split pin, attached to one of the arms of the wheel by a leather thong. The handle is secured to the wheel by a cotter which is attached similarly to the same arm. The wood quill is fixed on the handle by an iron nut.

In three carriages first issued, the mitre wheel on the hand-wheel shaft geared with an equal wheel on the worm shaft.

If the nuts on the bolts securing the caps on the top of the bracket be slackened, the cap may be turned so as to bring the handwheel in any position desired.

The bracket may be turned in its bearings in the beam, so as to bring the deck pinion, which engages a rack on the deck into position either for training or for running in. Before turning the bracket the deck pinion must be raised out of the rack. The bracket has two projections on it to facilitate its being turned or raised; when raised, it can be secured out of gear, by a metal pawl, which pivots on an iron stud screwed into the training beam, and is secured by a split pin. A similar stud is screwed into the lower side of the beam, for use in a left hand slide, in which case the beam would require to be turned over. The pawl fits under the collar S, on the bracket. When in gear the bracket may be clamped in position, either for training or for running in, by putting a metal stop pin through one of the holes in the collar into the hole in the beam. There are four holes in the collar, two for training and two for running in, for use with right and left hand mountings respectively.*

The worm shaft itself can be clamped, when desired, by the clamp bolt of Muntz metal which passes through the bracket and has a groove in it, in which the shaft fits. By screwing up the nut, the bolt is forced against the shaft.

There are similar bolts of Muntz metal with nuts, which pass through the training beam, and can be used to clamp the stems of the rear roller swivels.

There is an iron handle riveted to the rear of the training beam at the centre.

The slide is fitted with two buffers, each consisting of an iron spindle with volute steel spring secured on the inside of each frame at the front, by two nuts and a key.

The following fittings are on the outside of the side frames:—

Right side—

1 Bracket for tube box.
1 „ for extractor.
1 „ for rimer.
2 Eyebolts.
2 Hooks for iron lever.
1 Hook for winch handle.
1 Inscription plate.

Left side—

Bracket for sliding worm spindle.
2 Loops.
1 Hook for winch handle.

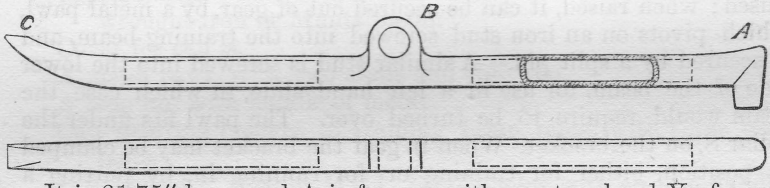
* Right hand mounting, A. Training, B. Running back.
Left „ „ C. Training, D. Running back.

1 Hook for spanner for inner gland.
1 Loop for spanner for outer gland.
Retaining pawl and stop pin as for 4″, but the handle of stop pin is straight.

The following stores are required for use with the mounting:—
Training handle.
Winch „
Handspike of iron, or future manufacture, of steel.
Clamping spanner.
Spanner, hydraulic buffer, No. 9.
„ „ No. 10.
Spanner for elevating gear.

The handspike is of the form shown in Fig. 135.

Fig. 135.



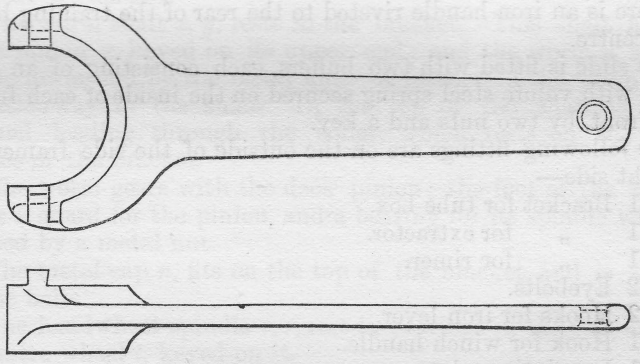

It is 31·75″ long, end A is for use with capstan head Y of rear roller swivel bearing. B for use as wrench to turn training pillar. End C to release front drop pin. The tubular handspike shewn in the figure is now superseded by a solid one of steel.

The clamping spanner is for use with the clamping bolt of the training gear. It is a box spanner of metal.

Spanner No. 9 for the inner gland screw and the rear caps of the cylinders has been described with the 4″ carriage.

§ 5137. Spanner No. 10 is of P.B., of the form shown, Fig. 136, and is used with the outer gland screw of the 5″ only.

Fig. 136.



5″ B.L. Carriage and Slide. Mark II.

This mounting is generally similar to the 5″ Mark I; the chief differences being in the training gear, and the method of attaching the slide to the sliding pivot.

The carriage consists of a gun-metal casting generally similar to the 5″ Mark I. The cylinders are tested before issue to a pressure of 1,500 lbs. per square inch.

The right side of the transom is cut away to allow the carriage to be dismounted without removing the upper pinion of the training gear.

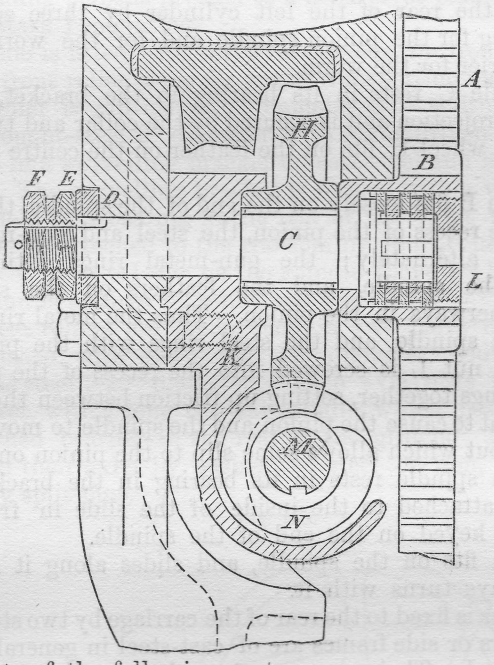
In addition to the channels in the transom there is an emptying hole at the outside of the right cylinder closed by a P.B. screw plug.

The buffers are similar to those of the Mark I carriage. The piston is set so as to completely close the valve at 24·25″ recoil. This gives a recoil of about 19¼″ in practice. The piston is secured from turning by a key which fits in a slot in the lug of the slide, and is secured by a small screw.

Elevating gear.

The elevating gear, Fig. 137, is generally similar to that for the Mark I carriage, but has five friction rings, in place of the two friction cones.

Fig. 137.




It consists of the following parts:—

An arc A of forged steel 18 teeth, radius 32·75″, graduated to give 15° elevation and 8° depression in degrees and intervals of 10 minutes, rigidly attached to patch on gun by two screws.

An elevating pinion B of cast steel, 10 teeth, 3·82″ diameter, recessed to receive the friction rings. The recess has two keyways cut in it and its outer portion is screwed.

Spindle for pinion C of steel, with a wrought-iron collar D and two nuts E, F. The spindle has four feathers forged on its inner end, for the friction rings, and two feathers for the worm wheel. It has a keyway in its outer end, for a feather on the collar D.

A wormwheel H of gun-metal, 20 teeth, 6·36″ diameter.

Three friction rings of steel, each with two feathers, and two of gun-metal each with four keyways.

A gun-metal nut L for pinion.

A bracket, elevating K, of gun-metal, with three screws.

A worm, elevating, N, gun-metal, with feather.

A spindle worm, sliding, M, of wrought-steel, 59·15″ long, 1·5″ diameter, with wrought-iron collar and nut, and P.B. pin. It has a groove along its length for the feather in the worm to slide in; a feather at rear end, and a groove round it to indicate extreme limit of recoil.

A handwheel of gun-metal 12″ diameter, with hollow wrought-iron handle riveted in.

A pointer of gun-metal with two steel screws.

The elevating bracket K is attached to the inside of the outer projection at the rear of the left cylinder by three screws. It forms a bearing for the pinion spindle and for the worm spindle, and also a carrier for the worm.

The spindle C rests in its bearing in the bracket, it passes through the projection and is secured by the collar and two nuts.

The worm wheel H fits on the feather on the centre part of the spindle.

The pinion B fits loosely on the end of the spindle, the friction rings fit in the recess of the pinion, the steel and gun-metal rings being placed alternately; the gun-metal rings fitting on the feathers on the spindle, and the feathers on the steel rings entering featherways in the pinion. Thus the metal rings always turn with the spindle, and the steel rings with the pinion.

The metal nut L is screwed into the recess of the pinion and presses the rings together, setting up friction between the alternate rings, sufficient to cause the pinion and the spindle to move together in elevating, but which allows some slip to the pinion on firing.

The worm spindle rests in its bearing in the bracket K, and in a bearing attached to the inside of the slide in front. The handwheel is keyed on the end of the spindle.

The worm fits on the spindle, and slides along it during recoil, but always turns with it.

The pointer is fixed to the rear of the carriage by two steel screws.

The slide.

The girders or side frames are of cast-steel in general form like those of Mark I. Their upper surfaces have a liner or covering of hard rolled manganese bronze attached by Muntz metal rivets.

The frames are connected in front by a front transom of cast steel, riveted to them. A holding down clip is formed on the under side of the casting, and holes for the securing screws in its ends.

A shield of steel plate, 1·5″ thick, is bolted to the front of the slide, one bolt passes through a box formed on the front of each girder above the lug for the piston rod, three other bolts on each side connect the shield with the lower part of the girders. The bolt through the boss rests in a gas pipe bearing, which will probably crumple up if the shield be struck, and thus prevent injury to the slide.

A front top transom of plate iron ·5″ thick is riveted across the front.

The girders are also connected by a rear transom which consists of two plates of angle iron riveted underneath the lower flanges. On these plates a T iron plate is riveted. The lower plates project along the girders at each side, and have a loop at each end.

A bracket of cast-steel or M.C.I. is riveted to the rear transom.

A rear flap of gun-metal is hinged to this bracket by a steel pin, secured by a nut. The flap is secured, when not in use, by an iron keep pin, attached to the bracket by a brass chain.

Pivot.

The front transom is connected by a wrought-iron link with a sliding pivot of cast-steel. The link fits on pins of wrought-iron 2·377″ diameter, one of which rests in bearings in the front transom and is secured by a split pin; the other is similarly secured in the sliding pivot. Both links and pins have loop holes.

The sliding pivot is pivoted to a deck pivot plate of gun-metal, as in the Mark I mounting.

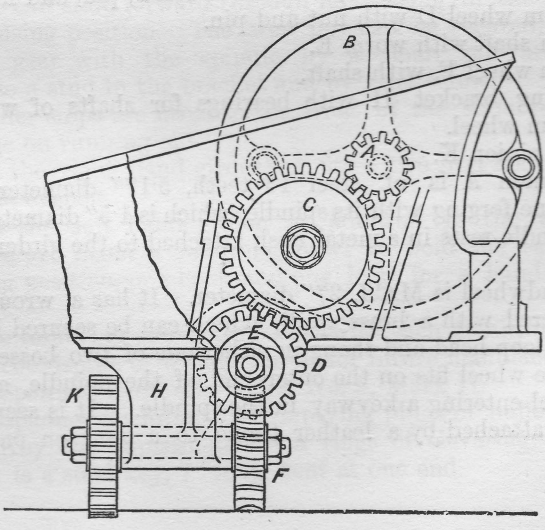
Rollers.

The slide is fitted with three rollers, one in front and two in rear; the front roller being for use in transporting only.

This roller is gun-metal, 6″ diameter, 3·5″ width of sole. Its axle is wrought-steel 2″ diameter, with a key driven hard in. The axle rests in a swivelling bracket of cast-steel and is secured by a split pin. The swivelling bracket is formed with a vertical spindle which is held in a bearing in the rear of the front transom, by a gun-metal cap attached to the transom by four bolts. A capstan of cast-steel or M.C.I. fits on the spindle above its bearing in the transom and is secured by a nut and pin.

The rear rollers are made each in two parts of cast-steel or M.C.I. bushed with gun-metal, 12″ diameter, width of sole 2″. The axle is steel 2·25″ diameter. Each axle rests in a wrought-iron bracket, with a long vertical spindle, which passes through a metal bushed bearing in the rear of the girders. The rollers are secured on their axles by washers of steel or iron, and flat keys secured by split pins.

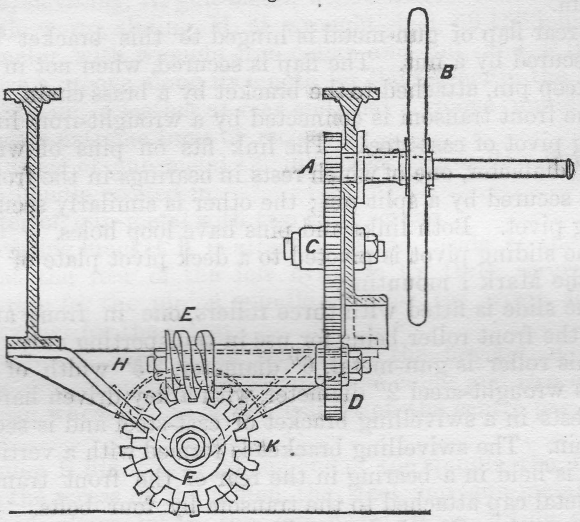
Fig. 138.



Guards of gun-metal to cover the rollers are bolted to the brackets.

The rollers are secured in position for training by set screws with loop heads, which pass through the rear of the girders and enter recesses in the spindles of the roller brackets.

Fig. 139.




Training gear.

The training gear, Figs. 138, 139 is altogether different from that for the Mark I slide. It consists essentially of a deck pinion, which works in a fixed rack on the deck and is on a short shaft held in a bearing under the centre of the slide. On the rear end of this shaft is a worm wheel, gearing with a worm worked by a handwheel on the outside of the right hand girder side, through a train of spur wheels on the inside of the side.

The following are the parts :—

A pinion A with spindle, 1st motion, handwheel B and bush.
An intermediate wheel C, with shaft, collar, pin, and nut.
A bottom wheel D with nut and pin.
A worm shaft with worm E.
A worm wheel F, with shaft.
A training bracket H with bearings for shafts of worm and worm wheel.
A deck pinion K.

The pinion A is of steel 13 teeth, 5·17″ diameter. It is formed in one forging with its spindle, which is 1·5″ diameter.

The spindle rests in a metal bush attached to the girder by four screws.

The handwheel is M.C.I. 27″ diameter. It has a wrought-iron handle covered with a brass quill, which can be secured by a set screw with loop head and thong in either one of two bosses on the wheel. The wheel fits on the outer end of the spindle, a feather on the wheel entering a keyway in the spindle. It is secured by a set screw attached by a leather thong to a stud on one of its arms.

The intermediate wheel C gears with the pinion. It is of cast-steel or M.C.I. bushed with gun-metal, 33 teeth, 13·13″ diameter. It is secured by an iron collar and split pin on a shaft of forged steel, which passes through the girder and has a nut on its outer end.

The bottom wheel D, gears with the intermediate wheel. It is of cast-steel or M.C.I., 27 teeth, 8·35″ diameter. It is keyed on the outer end of the worm shaft, and is secured by a nut and pin.

The worm shaft is steel, 2″ diameter. It rests in its bearing in the gunmetal bracket H, which is riveted across underneath the side frames, at the centre.

The worm, E, is of forged steel, keyed on the shaft, and secured by a nut and pin.

The worm wheel, F, is of gunmetal, 14 teeth, 8·91″ diameter.

Shaft for worm wheel and deck pinion is of steel, 2″ diameter, it rests in its bearings in the training bracket.

The worm wheel is keyed on the rear end of the shaft, and secured by a nut and pins. A second keyway is cut in the bush of the wheel, to enable a second key to be inserted to tighten it if found necessary.

The deck pinion is similarly secured on the front end of the shaft. It is of cast steel or M.C.I., 20 teeth, 11·14″ diameter. It gears with a gunmetal rack fixed to the deck.

The face of the pinion nearest to the pivot is marked *Front.*

Guards of sheet brass are attached by screws to the bracket and transom to cover the worm and deck pinions. Lubricating pipes of brass closed by screw plugs lead from the guard to each end of the bearing of the worm wheel shaft.

Fittings.

A gunmetal bracket is attached to the outside of the left hand girder by four screws. This bracket passes through the side and forms a bearing for the front of the sliding worm spindle. It also forms a bearing for an iron stop pin with loop handle, which, when in position, bears against the front end of the spindle, and prevents it sliding forward. On withdrawing the stop pin, the spindle can slide forward through its bearing in the bracket, into the housing position. The stop pin can be secured, either in or out of gear with the spindle, by a small pin attached by a chain to a stud in the bracket and by a set screw.

Buffer stops are fitted to the front of the slide to receive the carriage on running out.

On the right hand girder are fitted two iron hooks for spanner and one eyebolt.

On the left hand girder, in addition to the worm spindle bracket, are fitted a retaining pawl to hold the carriage in the housing position, one hook and one loop for a handspike and an eyebolt.

The following stores are issued with each mounting :—

1 Handspike of wrought-iron (for future manufacture of steel).
1 Spanner, hydraulic buffer, No. 9, Mark II.
1 Spanner for filling and emptying plugs of buffers, No. 7.
1 Key nut adjusting friction rings of elevating pinion. This is a steel key, 7″ long, bent at one end.

1 Spanner, gear elevating for pinion nut. This is the double ended spanner, used also for elevating gear of 5″, Mark I and 4″.

The following are also required :—

A measure tin, hydraulic cylinder filling, one to every six or less number of carriages.

Strainer for ditto, ditto.

A spanner, McMahon, 21″, one to every two or less No. of mountings.

## 6″ B.L. Carriage and Slide, Mark I.

Carriage. § 4677.

The carriage, Figs. 140, 141, consists of two brackets, A, A, each a separate casting of steel. Each bracket forms the cylinder of a hydraulic buffer, as in the 4″ and 5″ carriages.

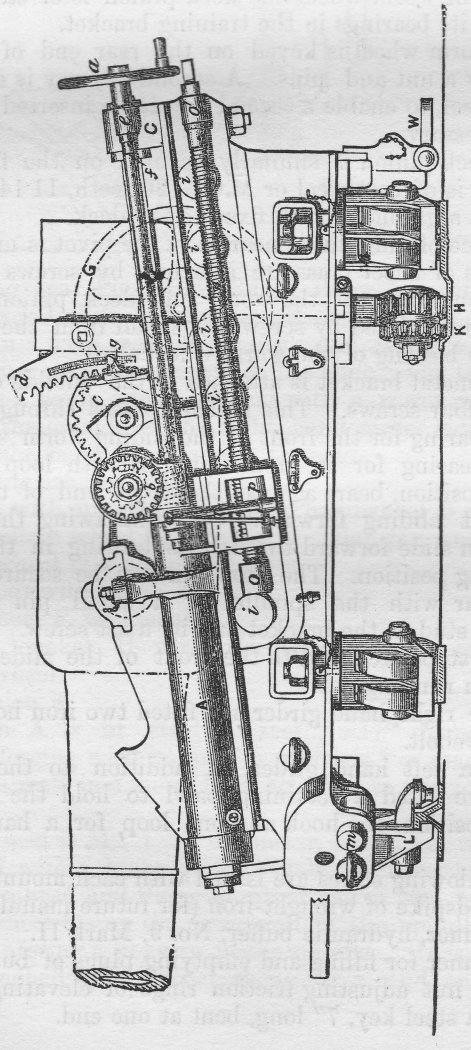



Fig. 140.

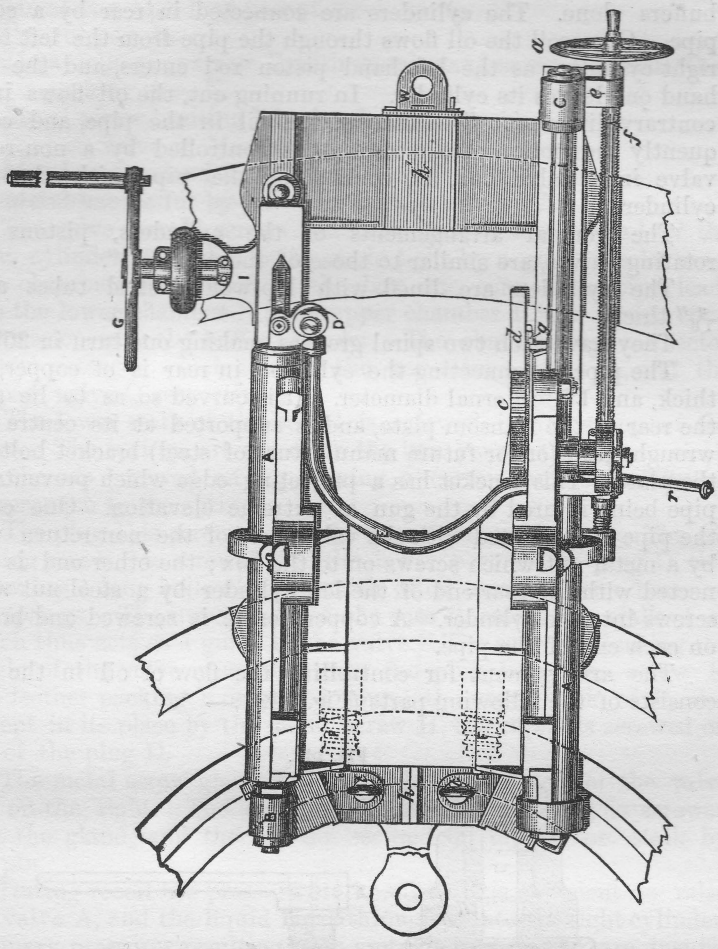


Fig. 141.

The brackets are connected by a wrought-iron bottom plate (for future manufacture to be of steel) stiffened by a transom of angle iron or steel riveted to them at the front.

Striking brackets to bear against the front buffer stops of the slide on running out are riveted underneath the bottom plate. Grooves for lubricating are cut in the trunnion bearings. The capsquares are of metal, and are similar to those for the 4″ and 5″. There are also grooves for lubricating in the under side of the brackets, to which channels through the brackets closed by screw plugs communicate.

The carriage is kept in position on the slide by clips along each bracket on the inside which form part of the casting.

Hydraulic buffers.

The piston rod of the right cylinder is in tension, that of the left in compression during recoil. This arrangement enables the carriage to be kept under control in a seaway, or retained in any desired position on its slide by the action of the hydraulic

buffers alone. The cylinders are connected in rear by a copper pipe. On recoil the oil flows through the pipe from the left to the right cylinder; as the left hand piston rod enters, and the right hand one leaves its cylinder. In running out, the oil flows in the contrary direction. The flow of the oil in the pipe, and consequently the motion of the carriage is controlled by a non-return valve in a valve box, D, connecting the pipe with the right cylinder.

The general arrangements of the cylinders, pistons and rotating valves, are similar to those of the 4″ and 5″.

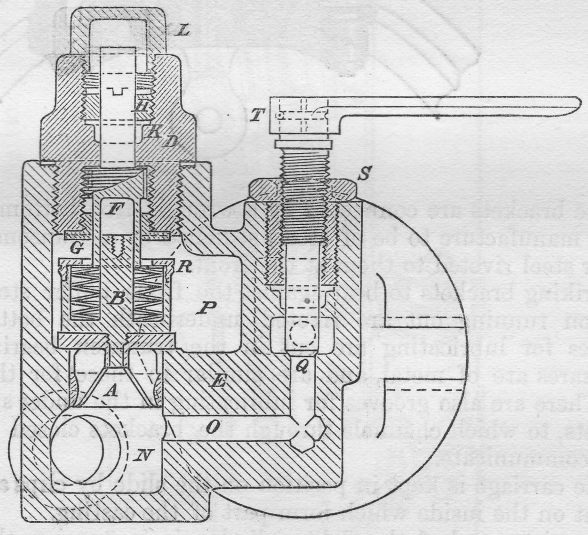
The cylinders are lined with lap-welded steel tubes about $\frac{2}{10}$″ thick.

They have each two spiral grooves, making one turn in 257″.

The pipe E connecting the cylinders in rear is of copper, ·25″ thick, and 1·5″ internal diameter. It is curved so as to lie along the rear of the transom plate, and is supported at its centre by a wrought-iron (or for future manufacture of steel) bracket bolted to the plate. This bracket has a projecting edge which prevents the pipe being injured by the gun at extreme elevation. One end of the pipe is connected with the valve box of the non-return valve by a metal nut which screws on to the box; the other end is connected with the rear end of the left cylinder by a steel nut which screws into the cylinder. A copper ferule is screwed and braized on each end of the pipe.

The arrangement for controlling the flow of oil in the pipe consists of the following parts (Fig. 142):—

Fig. 142.




A metal valve box, E.
Metal plug for valve box, D.
Metal cap, L.
Non-return valve, A.

Metal box with four pair of steel springs, B.
Cap for box, R.
Metal adjusting screw F, with metal gland screw H, and leather packing ring, K.
Metal screw limiting lift of valve G.
By-pass valve of Muntz or gun metal Q.
Metal screw gland for by-pass valve, S.
Metal handle for by-pass valve with split pin, T.

The valve box E screws into and closes the rear end of the right cylinder; the joint being made tight by a gutta-percha ring. Two chambers are formed in the box, the connecting pipe leads into the lower chamber N; the upper chamber P is in direct communication with the buffer cylinder. The chambers are connected by two passages, which contain the non-return valve A, and the by-pass valve Q respectively.

The lower stalk of the box B is screwed into the top of the valve. The springs are placed in the box round the upper stalk, and the cap screwed on top, giving a certain amount of initial compression to the springs.

The plug D is screwed into the top of the valve box. The adjusting screw F is screwed into the lower part of the plug D, this screw has a long hollow stalk, which when screwed home bears on the springs. The upper stalk of the case B, enters the stalk of F, which thus acts as a guide to the valve. The screw G limiting the height of the valve is screwed into the plug below the screw F. The leather packing K is placed round the upper stalk of F, and is kept in its place by the gland screw H, the cap L is screwed on top of the plug D.

The metal screw gland S is screwed into the top of the valve box on the right. The stalk of the by-pass valve Q is screwed into the gland, and the handle secured on top of the stalk by the pin.

During recoil the pressure of the oil in N is sufficient to raise the valve A, and the liquid flows through P into the right cylinder. Ordinary pressures resulting from motions in a seaway are insufficient to compress the springs and raise the valve A, and if the by-pass valve be screwed down no motion of the carriage can take place. When it is desired to run out, the by-pass valve is opened by turning the handle to the front, and the oil then flows from the right cylinder by the passage O, into the chamber N, and back through the pipe to the left cylinder. Packing,

The cylinders are filled through the valve box. There is an air hole in the left cylinder near the rear closed by an iron screw plug, and an emptying hole closed by a steel screw plug at the outside of each cylinder near the front. The front end of the left cylinder is closed by a wrought-iron (for future manufacture, steel) screw cap with gutta-percha ring.

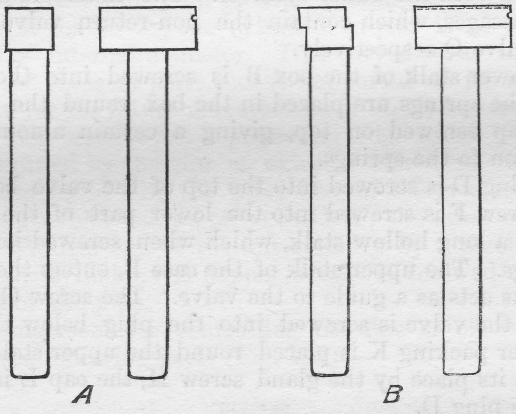
In the stuffing box of each cylinder is placed a metal plug. A leather ring is placed in the end of this plug. An inner gland of steel is screwed into the plug on the leather ring. This gland contains the packing which consists of eight plaits, each of eight strands of cotton wick.

An outer screw gland of metal is screwed into the inner gland on the packing.

The cylinders are tested before issue to a pressure of 3,000 lbs. on the square inch. The pressure to which the cylinders have been tested is marked on the outside in front of the trunnion bearing.

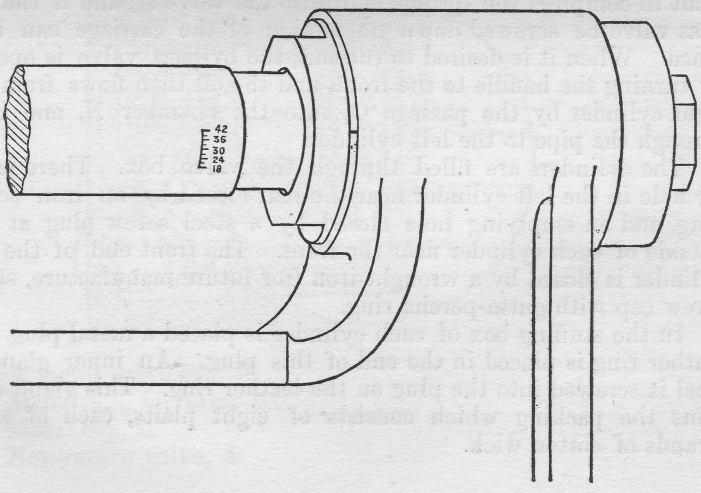
The front end of the right piston rod is secured to a lug on the front of the slide by two steel nuts. The front nut enters a recess in the lug, and the piston is prevented from turning by a key of the form A shown in Fig. 143. The head of the key fits in a slot

Fig. 143.




in the nut and keyway in the lug, and the shank passes through a hole drilled in the rod. To withdraw the rod it is necessary first to screw back the nut in rear of the lug, then draw the piston rod forward till the front nut is clear of the lug, when the key can be withdrawn and the front nut taken off. The rear end of the left

Fig. 144.

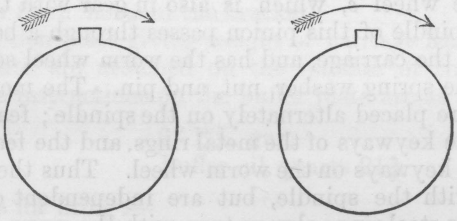


hand piston rod is similarly secured to a bracket at the rear of the slide.

The extreme recoil which can be obtained is 42″, but the pistons are set to give a safe recoil between the limits 37″ and 40″. To enable the piston rods to be adjusted at any time, should the recoil be found excessive, a scale, Fig. 144, is marked on each piston rod. close to the point where it enters the lug or bracket. This scale shows the amount the piston rod must be turned in order to alter the recoil by intervals of 3″ from 42″ to 18″.

The scale is intended to be read from a gauge applied against the horizontal line on the face of the lug. To reduce the recoil. the piston must be turned until the required figure on the scale coincides with the horizontal axis of the lug or bracket.

Fig. 145.



R. Hand.
Front view.
To shorten recoil, turn rod in direction of arrow.

L. Hand.
Front view.
To shorten recoil, turn rod in direction of arrow.

The key already mentioned is called an A key, and is the one generally used when the mountings are first issued. In some cases the piston rods and slides were fitted with these keys before proof, and the recoil at proof being excessive, it was necessary to turn the piston rods, so that the slots in the nuts and the keyways in the slide no longer corresponded. A B key, Fig. 143, having a different form of head is used with these mountings. The upper part of the head fits in the keyway in the slide and the lower in the slot in the nut. B keys might be used at any time with mountings fitted for A keys, should it be required to reduce the recoil.

The letter denoting the form of head, whether A or B, and also the No. of the mounting is stamped on the heads of all keys at the front end.

In using B keys, care must be taken to insert the key with its head in the proper direction, as shown by the letter at the front, and by a groove on the rear face.

The letter denoting the key used is also stamped on the front face of the lug for right hand, and on the *rear* face of the bracket for the left hand piston rod.

**Elevating gear.**

The elevating gear consists of the following parts :—

An arc, *d*, of wrought steel.
A wheel, *c*, of steel or M.C.I., 33 teeth, 13·13″ diameter, with spindle, nut and pin.
Elevating pinion, wrought steel or M.C.I., 12 teeth, 4·78″ diameter, with spindle, four metal and five steel friction rings, one metal and one spring washer.
Worm wheel *b*, metal, with steel spring, washer and steel nut.
Cover for worm wheel, of metal, with three steel screws.
Worm of metal with metal washer and steel nut.
Sheath for worm of metal with nut and screw.
Sliding worm spindle of steel with handwheel *a*.
Pointer of metal with steel bolt and nut with pin.

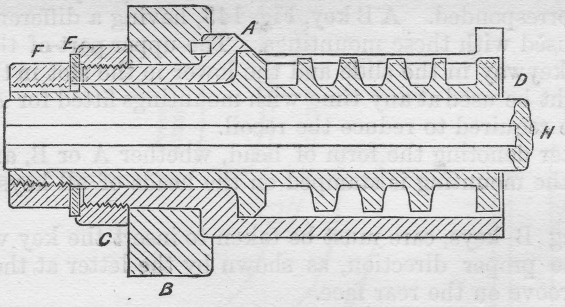
The arc is graduated in degrees and intervals of 10′ (from 20° elevation to 7° depression).* It is rigidly attached to the gun, and gears with the wheel *c*, which is also in gear with the elevating pinion. The spindle of this pinion passes through a bearing in the left bracket of the carriage, and has the worm wheel secured on its outer end by the spring washer, nut, and pin. The metal and steel friction rings are placed alternately on the spindle; feathers on the spindle fit in the keyways of the metal rings, and the feathers on the steel rings fit in keyways on the worm wheel. Thus the metal rings always turn with the spindle, but are independent of the worm wheel, while the steel rings always turn with the worm wheel.

By screwing up the nut at the end of the spindle, friction can be set up between the alternate rings sufficient to cause the spindle and worm wheel to move together in giving elevation or depression, but which does not prevent some slip of the spindle on firing.

The cover of the worm wheel is attached to the outside of the carriage bracket by the screws.

The front end of the worm sheath A, Fig. 146, passes through a loop B formed on the outside of the left hand cylinder, and is

Fig. 146.




secured by a nut C. A steady pin on the sheath fits in a hole in the loop, and the rear end of the sheath is attached to the cover of

* The carriage only allows 16° elevation and 6° depression.

the worm wheel by a screw. The front end of the worm D passes through the front end of the sheath, and is secured by a metal washer E, and the nut F. The worm spindle, H, passes through the worm, a feather in the worm fitting in a long keyway in the spindle.

The rear end of the spindle is supported in a bracket fixed to the rear of the slide. The bush for the spindle in the bracket is removable, and can be withdrawn, thus allowing the spindle to be disconnected from the carriage without removing the bracket. A groove near this end of the spindle marks the limit of extreme safe recoil. The handwheel is fixed on the end of the spindle by a cotter, secured by a split pin. An iron handle with metal quill is bolted on the handwheel.

The pointer is attached by the steel bolt and nut with pin to the rear of the carriage bracket.

Fittings.

A metal bracket for running in screw with flap, *p*, is housed into, and bolted to, outside of left cylinder. Two steady pins fixed to the cylinder fit in holes in the bracket.

An inscription plate giving weight of carriage &c., and a buffer instruction plate are attached on the outside of the right hand cylinder. The instructions on the buffer plate are as follows :—

6″ B.L. gun.
Buffer oil, quarts 21¾.

To prepare for firing :—

Remove plug from air hole in top of left hand cylinder, also plug of valve box and valve from right hand cylinder, insert strainer and pour in oil until it overflows at air hole, which is then to be closed by the plug, complete the filling and replace valve and plug of valve box. To ensure cylinder being full, run the gun in and out once. On emergency any lubricating oil may be used.

## The Slide.

The slide.

The slide consists of two girder side frames of cast steel, formed with flanges, on the inside at front and rear. The front flanges are riveted together, the rear flanges are connected by an iron tie plate *h*, riveted over them. The girders are also connected by a transom of channel steel near the centre.

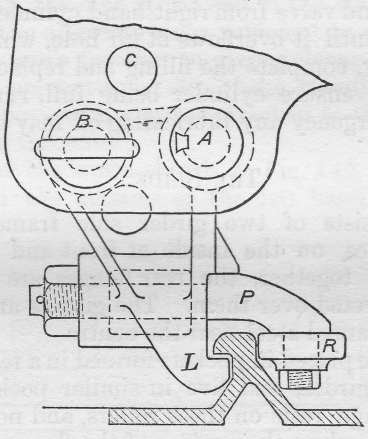
Seven rollers are placed in pockets formed in a recess in the upper part of the L.H. girder, and five in similar pockets in the R.H. girder. The carriage rests on these rollers, and not on the girders, except at the front, where the centres of the flanges are raised so as to be in the same plane with the upper surfaces of the rollers. The rollers are of steel or M.C.I., 8·008″ diameter. Their axles are steel, 2·5″ diameter. A feather on each axle fits in a keyway in the roller. The axles rest in metal bushes, *i*, *i*, attached to the side frames each by three screws. The axle bearings in these bushes are eccentric ; each bush has two holes in the outside to receive a spanner to turn it, if necessary, and also a lubricating channel closed by a rotating metal disc. When it is required to lubricate, this disc should be turned until a hole in it coincides with the

channel. The disc will be in the correct position when a line cut on its edge coincides with a similar line on the bush. Each bush is numbered to show its proper position on the girders, and these latter are also marked with numbers corresponding with those on the bushes. A pipe closed by a metal screw cap with leather washer for running off water, is screwed into the roller pockets at the front on each side. There are lubricating grooves across the upper surface of each side, an oil cavity with passage closed by a screw plug at the front of the right girder and a drip hole at the front of left girder.

The girders are supported on four pairs of rollers of cast steel or M.C.I. bushed with gunmetal, diameter 10″, width of sole 2·75″. Each pair of rollers run on a steel axle secured by a pin in a roller bracket of steel or M.C.I. similar to those for the 4″ and 5″ slides. The spindle of each bracket is secured in the girders by a nut and pin. The rollers can be secured in any desired position by steel stop pins, attached by chains to the girders, which enter holes in the roller brackets. These holes are not drilled until the mounting is in position on board ship.

A clip, L, is pivoted to the front of each side frame, by a hinge pin A, Fig. 147. A feather on the pin fits in a keyway in the clip;

Fig. 147.



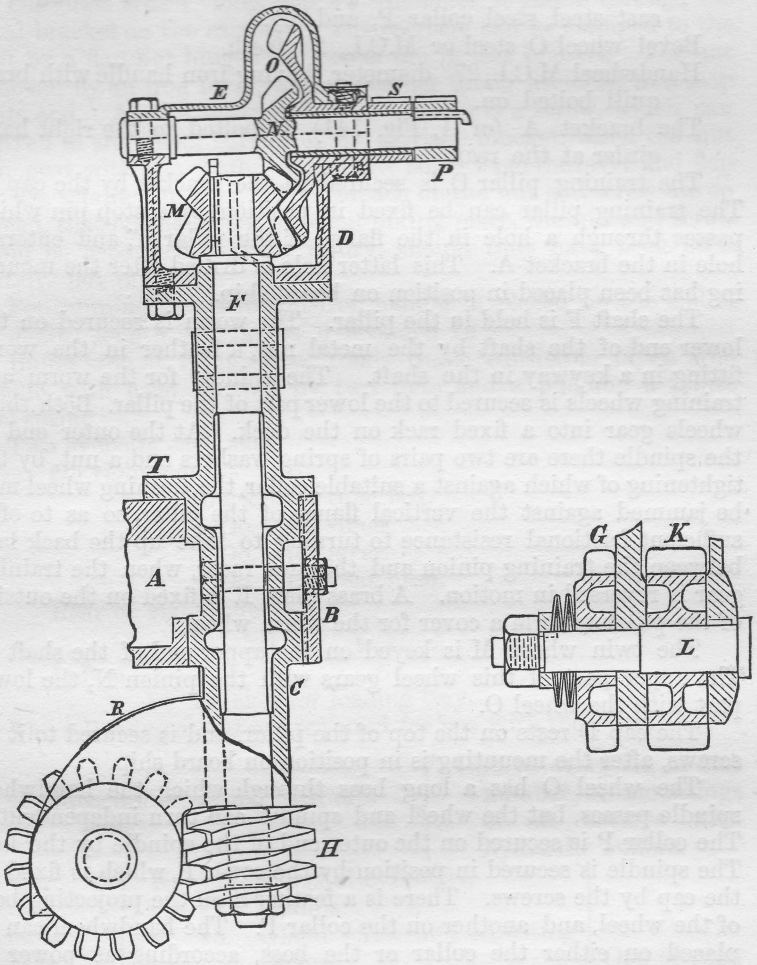

there is a capstan head on the end of the pin by which the clip can be turned. By means of a stop pin with handle, placed in one of the holes B, C, the clip may be secured either in or out of gear with a clip racer. A bent iron (for future manufacture, steel) gudgeon P, is secured to each clip by a nut, and a metal guide roller, R, which runs on the rear edge of the clip racer is secured on the end of the gudgeon.

A pivoting bar, which forms part of the deck fittings is secured

to the front of the slide by two steel drop pins with handles, 3·25″ diameter.

A bracket of steel or M.C.I. is bolted to the rear end of the slide. A rear flap of metal, W, is hinged to this bracket by a steel pin 1·5″ diameter, secured by a split pin. A stop pin for retaining the flap up out of position is attached to the bracket by a chain.

Fig. 148.




Training gear. Fig. 148.

The training gear consists of the following parts :—
A bracket, A (I Fig. 141), of steel or M.C.I. with 6 bolts.
A cap for bracket B, of metal with 3 bolts.
A training pillar C of metal.
A cap for „ „ D.
A cover of metal, E, for cap with 4 screws.
A training shaft of steel, F.
A worm H of wrought-iron, steel or metal, with a metal nut.

A worm wheel, K, of wrought iron, steel, M.C.I. or metal, 16 teeth, 7·63″ diameter.

A spindle for worm wheel of steel, L, with four spring plates a metal washer, nut, and pin.

A training wheel G, similar to the worm wheel.

Twin wheel for top of training shaft M, of steel, 14 teeth.

Spindle for handwheel with pinion N, 14 teeth, of forged or cast steel, steel collar P, and key.

Bevel wheel O, steel or M.C.I., 28 teeth.

Handwheel M.C.I., 27″ diameter, having iron handle with brass quill bolted on.

The bracket A (or I, Fig. 141), is bolted to the right hand girder at the rear.

The training pillar C, is secured in the bracket by the cap B. The training pillar can be fixed in position by a stop pin which passes through a hole in the flange of the pillar T, and enters a hole in the bracket A. This latter hole is drilled after the mounting has been placed in position on board ship.

The shaft F is held in the pillar. The worm is secured on the lower end of the shaft by the metal nut, a feather in the worm fitting in a keyway in the shaft. The spindle for the worm and training wheels is secured to the lower part of the pillar. Both these wheels gear into a fixed rack on the deck. At the outer end of the spindle there are two pairs of spring washers and a nut, by the tightening of which against a suitable collar, the training wheel may be jammed against the vertical flange of the pillar, so as to offer sufficient frictional resistance to turning to take up the back lash between the training pinion and the rack racer, when the training gear is reversed in motion. A brass plate R is fixed on the outside of the pillar to form a cover for the worm wheel.

The twin wheel M is keyed on the upper end of the shaft F. The upper part of this wheel gears with the pinion N, the lower part with the wheel O.

The cap D rests on the top of the pillar, and is secured to it by screws, after the mounting is in position on board ship.

The wheel O has a long boss through which the handwheel spindle passes, but the wheel and spindle can turn independently. The collar P is secured on the outer end of the spindle by the key. The spindle is secured in position by the cover E, which is fixed on the cap by the screws. There is a feather S on the projecting boss of the wheel, and another on the collar P. The handwheel can be placed on either the collar or the boss, according as power or speed may be desired in training. When in position it is secured by a pin with loop head, which enters a recess in boss or collar as the case may be. There is a spring round this pin in the boss of of the handwheel.

There is a lubricating channel in the top of the training shaft, to which a tube, closed by a screw plug, leads from the cover.

A clamping bolt of Muntz metal with nut is fitted to the pillar similar to that for the 5″, Mark I.

The bracket C, Fig. 141, for securing rear end of left-hand piston

rod is of forged steel; it has a shank which passes through a hole in the girder, and is secured by a nut. This bracket contains also a bearing with metal bush secured by set screw for the rear end of the sliding worm spindle.

A steel screw shaft rests in bearings in two iron brackets secured to the outside of the left girder each by two nuts and a pin. Running in gear.

The shaft is 62·1″ long, and 2·5″ diameter, it passes through the metal bracket on the carriage. The carriage can be clamped to the shaft by a flap nut hinged on a steel pin in this bracket. The nut is moved by an iron lever, with a leather thong attached to a loop on its end. At the other end of the thong is a screw, which can be fixed in the upper surface of the carriage bracket, when the nut is in gear with the shaft. The screw being fixed the lever and flap nut are retained in gear. The threads on the nut and screw are so formed, that on the action of recoil taking place, the nut and screw would be separated without injury, should they have been accidentally left in gear.

For running in a wrought-iron handle is placed on the end of the shaft: length 24″, radius of leverage 10·5″.

Buffer stop at front of each side frame, consisting of an iron spindle with head, secured by two nuts and a pin, and a volute steel spring. Fittings.

Two eyebolts each side.

On right side:—

Bracket for tube box.
Do. for rimer.
Do. for lever.
Do. for vent head.

Rear of right side:—

Bracket for extractor.

Left side:—

Bracket for loading tray.

The following stores are required for use with the mounting:—

Stores. § 5104.

| | | |
|---|---|---|
| Measure for filling hydraulic buffer. | One to every six or less number of mountings of all natures with hydraulic buffers. | |
| Spanners, hydraulic buffer, Fig. 149. | No. 11. Plugs of cylinders. | One of each to every four or less number of Mountings. |
| | „ 12. Glands „ | |
| | „ 13. Gland screw and adjusting screw. | |
| | „ 14. Front cap of left cylinder and valve box. | |
| | „ 15. Plug, valve box, and screw adjusting lift of valve. | |
| | „ 16. Gland and valve box, caps and by-pass valve. | |
| | „ 17. Nuts for piston rods. | |
| | „ 18. Air hole and run-off plug. | |

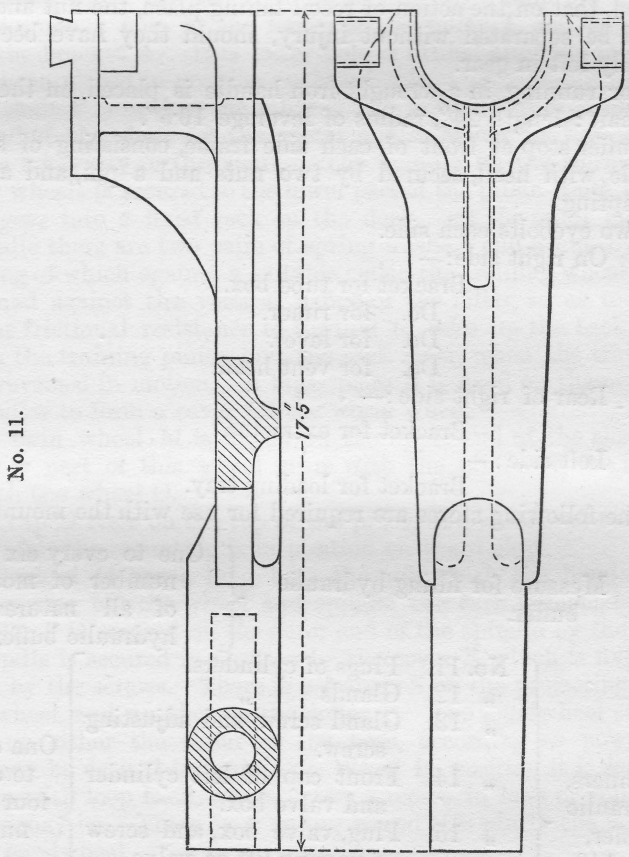
| | |
|---|---|
| Loop, lifting valve<br>Funnel, copper, filling cylinder with strainer. | One of each to every four or less number of mountings. |

Box, implement.

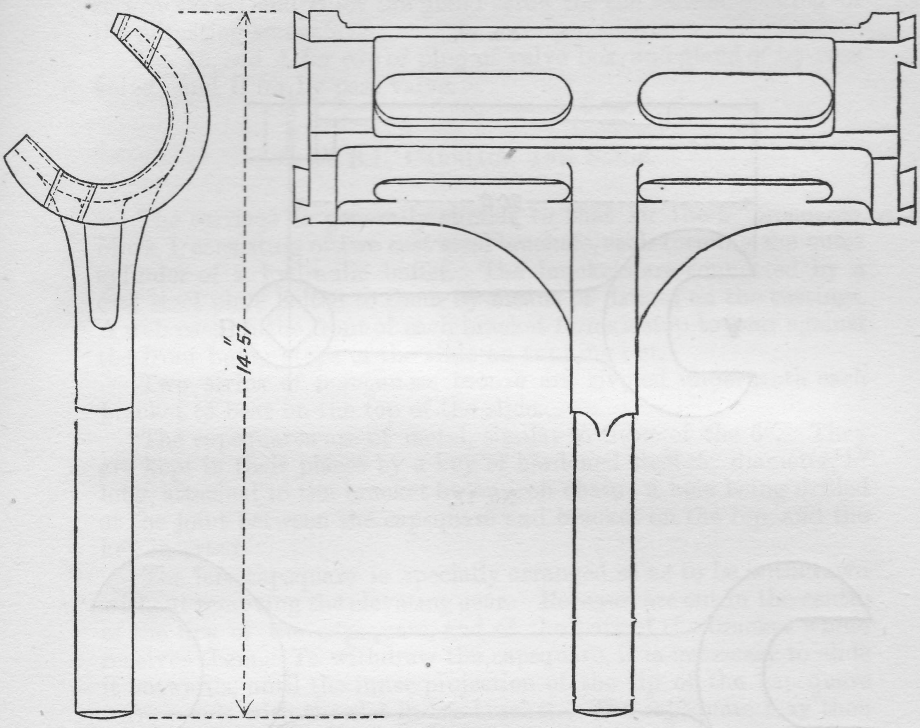
The spanners, loop and funnel are contained in an implement box. This box is of deal with elm ends, bound with iron at the corners, dimensions 2′ 7″ × 1′ 6″ × 10·125″. It has a hinged lid bound with iron and secured by a hasp and turnbuckle. It is fitted with an iron handle at each end, and is arranged internally with cleats to receive the implements above-mentioned.

The form of the spanners are shown in Fig. 149.

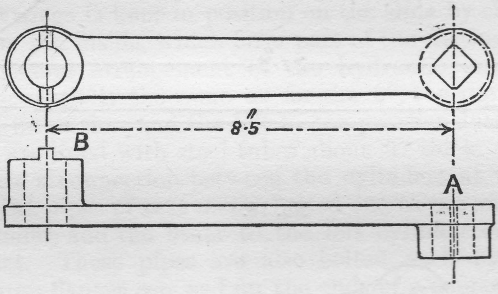
Fig. 149.



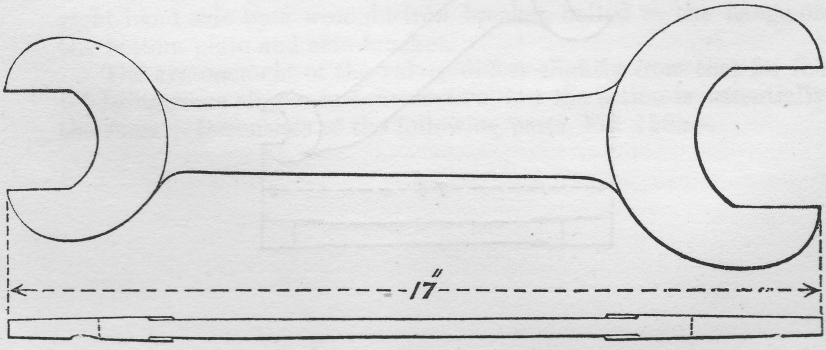
No. 12.



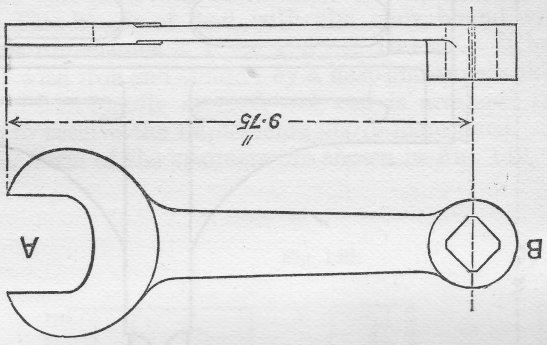

No. 13.



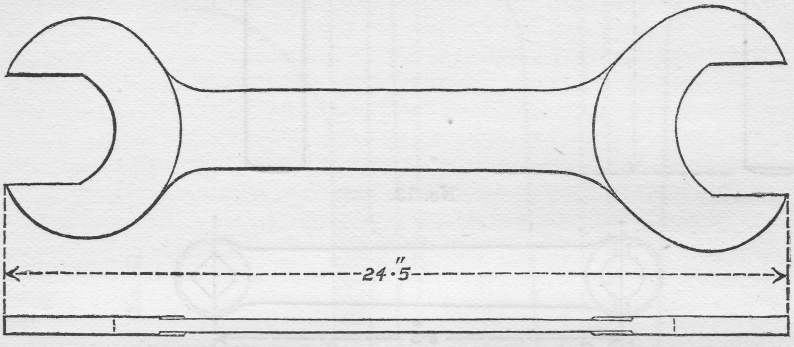

No. 15.



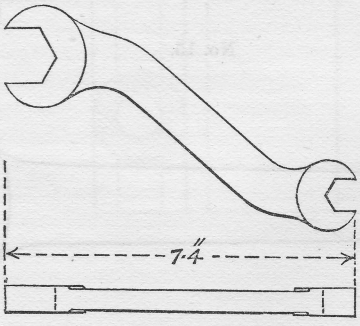
No. 16.




No. 17.




No. 18.



In No. 13 spanner, end A is for the adjusting screw of the non-return valve; end B for the gland screw for the leather packing of the adjusting screw.

No. 16, end A for cap of plug of valve box, and gland of by-pass valve; end B for by-pass valve.

## 8″ B.L. Carriage and Slide.

**Carriage.**

The carriage is generally similar to that for the 6″ broadside, Mark I, consisting of two cast steel brackets, each forming the outer cylinder of a hydraulic buffer. The brackets are connected by a cast steel plate bolted to them by means of flanges on the castings. A web cast on the front of each bracket forms a stop to bear against the front buffer stops of the slide on running out.

Two strips of manganese bronze are riveted underneath each bracket to bear on the top of the slide.

The capsquares are of metal, similar to those of the 6″. They are kept in their places by a key of hardened steel ·5″ diameter, 1″ long, attached to the bracket by an iron chain: a hole being drilled at the joint between the capsquare and bracket on the top, and the key inserted.

The left capsquare is specially arranged so as to be withdrawn without removing the elevating gear. Recesses are cut in the centre of the lips of the capsquare, and of the part of the bracket which receives them. To withdraw the capsquare, it is necessary to slide it outwards, until the inner projection of the lip of the capsquare corresponds with the slot in the bracket. The capsquare may then be lifted out vertically by a handle screwed into it.

The carriage is kept in position on the slide by clips along each bracket, on the inside, which form part of the casting.

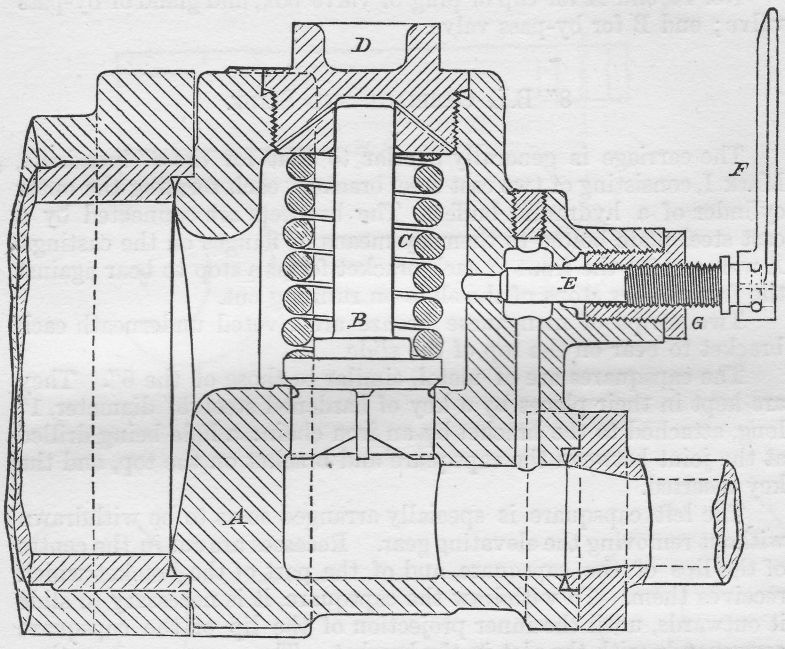
**Hydraulic buffers.**

The general arrangement of the hydraulic buffers and their action is essentially the same as for the 6″, the right-hand piston rod being in tension, and the left in compression during recoil. The cylinders are lined with steel tubes about ·6″ thick.

To form a connection between the cylinders at the rear, there are two bent pipes of cast metal, bolted one to the valve box on the right cylinder, and the other to the left cylinder on the inside of the bracket. These pipes are also bolted, each by two bolts to wrought-iron flanges screwed on the ends of a copper pipe, bent so as to lie along the rear of the bottom plate, and supported on the right-hand side by a wrought-iron bracket bolted to the flange on the bottom plate and side bracket.

The arrangement of the valves differs slightly from that for the 6″, being more simple in construction, but the action is essentially the same. It consists of the following parts, Fig. 150 :—

Fig. 150.



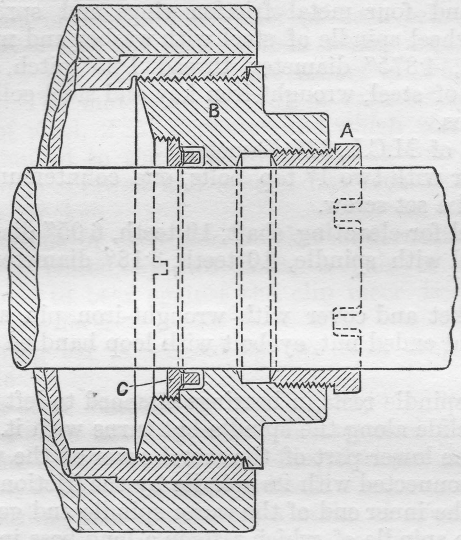

Metal valve box A.
Running-out valve B.
Spiral spring C for do. 2·75″ over centres.
Metal plug D for valve box.
By-pass valve E, with metal handle F, and split pin.
Cup leather and screwed gland G for do.

The running out valve B is placed in its seating, and the spring C round the shank of the valve; the metal plug D is screwed down on to a gutta-percha ring. The by-pass valve E is screwed into the gland G, and the cup leather placed on the end. The whole is then screwed into the valve box together.

The plugs for the emptying holes and air hole, and the plug for the front end of the right hand cylinder are of metal.

The stuffing box of the cylinder, Fig. 151, is formed in a metal screw plug, with a gutta-percha ring. A U leather kept in its place by a screwed metal ring is fitted in a recess in the inner face of the plug; cotton packing pressed in by a metal screw gland is contained in a recess in the outer face.

Fig. 151.




The cylinders are tested to a pressure of 3,000 lbs. on the square inch; the pressure to which they are tested is stamped on the flange on the rear of the right cylinder, and on the side of the left cylinder.

Each piston consists of two collars formed solid with the rod, a rotating valve working between them. The valve is formed in two separate pieces, secured together by two cheese headed screws ·625″ diameter. Each portion of the valve has a tongue piece to fit in the grooves cut in the cylinder. A longitudinal channel ·75″ diameter is drilled nearly through the left hand piston rod and one of ·5″ diameter through the right hand rod: the end of the latter, which passes through the lug on the slide being plugged up. A second channel is drilled at right angles to the first and meets one drilled in the lug on the slide and a metal valve screwed through into the piston rod on to a leather washer. A copper pipe leads from each valve to a double acting pump attached to the rear end of the right side of the slide. By working the pump the liquid is forced from the left into the right cylinder thus causing the carriage to run in.

The piston rods are secured by flat keys driven into the rods and fitting into keyways cut in the lugs, steel nuts being screwed on to the ends of the rods.

The elevating gear is similar to that for the 6″ and consists of the following parts:—

Elevating gear.*

A steel arc, 10 teeth.

A cast-steel spur wheel for elevating arc, 33 teeth, 15·78″ diameter, with steel spindle, washer, and screw.

* The carriage will admit of 10° elevation and 4½° depression.

A cast-steel spur pinion, 12 teeth, 5·86″ diameter.
A cast-steel worm wheel, 46 teeth, 18·3″ diameter, with four steel and four metal friction rings and spring washer; worm wheel spindle of steel with washer and nut.
Steel worm, 4·875″ diameter, thread 1·25″ pitch, with sliding spindle of steel, wrought-iron key and steel collar and two split pins.
Handwheel of M.C.I., 24″ diameter.
Metal cover with two 1″ tap bolts, one countersunk ·875″ tap bolt and a set screw.
Bevel wheel for elevating shaft, 19 teeth, 6·05″ diameter.
Bevel wheel with spindle, 10 teeth, 3·18″ diameter, and winch handle.
Metal bracket and cover with wrought-iron pin and nut, pin and solid ended nut, eyebolt with loop handled nut.

The worm spindle rests in bearings attached to left side of slide, the worm can slide along the spindle but turns with it. The worm is carried by the lower part of the metal cover of the worm wheel. This wheel is connected with its spindle by the friction rings. The pinion fits on the inner end of the worm spindle and gears with the spur wheel, the spindle of which rests in a long boss in the carriage bracket. The spindle is put in from the outside, and the wheel secured on its inner end by the washer and screw.

As an auxiliary to the handwheel, a bevel wheel is keyed to the rear of the worm spindle. This wheel is formed with a sleeve, on which the handwheel is keyed. It gears with a bevel wheel on a short horizontal spindle, held in the bracket supporting the end of the worm spindle. A winch handle can, when required, be placed on the spindle.

## The Slide.

The slide.

The slide consists as in the 6″ of two girders of cast-steel formed with flanges on the inside, front and rear. The front flanges are bolted together, the rear flanges are connected by a cast-steel transom, a wrought-iron tie plate being bolted underneath. There is also a transom bracket of cast-steel for the training gear, connecting the girders at the centre. The general arrangement of the slide is similar to the 6″.

Seven rollers are placed in pockets in a recess in the upper part of each girder. The rollers are of cast-iron, 8·52″ diameter, with a metal bush, they work on steel pins, 2·5″ diameter, fixed in position by means of metal bushes attached to the girders each by three screws. These bushes are eccentric, the outside ones have an elongated hole into which a projection on the axle fits and prevents it from turning. A lubricating hole is drilled in the axle through this projection and an oil channel cut on the under side. The axles and bushes are numbered and there are corresponding numbers on the slide to show their proper position.

The slide is supported on four sets of rollers, each set consisting of three rollers. A sleeve bushed with gun-metal, is cast on each side of the middle roller of each set. The axles rest in the sleeves, and the outer rollers which are also bushed fit over them. The diameter of the rollers is 9·5″ and width of sole 2·75″. The middle roller only of each set bears on the axle, which is of steel, 2·25″ diameter, and which rests in a cast-steel bracket attached to the slide by means of four bolts; the end of the axle is screwed and a steel nut secures it from working out of the bracket.

On the front of each side bracket underneath, there is a lug to which is bolted, by two bolts, a pair of clips. A metal bearing piece to bear against the clip racer is riveted to each clip on its rear face.

A pivoting bar is secured by two steel drop pins to the front of the slide.

A cast-steel bracket for housing flap is fitted on the left side of the slide near the rear. A cast-steel flap fits into the bracket and turns about a steel pin, the pin being secured in position by a steel pin with L head.

Training gear.

The training gear consists of a train of spur wheels on each side of the slide, worked by winch handles. From these the motion is transmitted through bevel gearing to a central shaft which rests in bearings formed in the training gear brackets. Two cast-steel pinions are fixed each by two keys on the shaft, these gear with two wheels formed in one casting with a deck pinion on a steel axle 2·5″ diameter, secured in the training gear bracket by a collar and split pin.

The gear is clamped by a screw clamp acting on an intermediate wheel on each side of the slide.

A cover of metal forming a bearing for the spindle wheel and pinion is provided for each side train, and a cover of steel plate for the central portion of the gear.

The following are the parts of the training gear:—

Two spindle pinions for winch handles, 12 teeth, diameter 4·78″.

Two spindle wheels 22 teeth, diameter 8·75″, with steel bevel pinion shaft with two keys fixed in shaft.

Two spur wheels, 46 teeth, diameter 18·3″,

Two bevel pinions 10 teeth, diameter 4·77″, with steel shaft, collar and pin.

One bevel wheel, 33 teeth, diameter 15·75″.

Two spur pinions, 13 teeth, diameter 6·635″.

Triple training wheel, 13 teeth, diameter 6·635″ and 14 teeth, diameter 8·76″, with steel pin with collar and L headed split pin.

Two metal guards each in three parts, with steel stay and two 1″ hexagon headed, one 1″ cheese head with slot, tap bolts, thirteen ·75″ bolts and nuts, five 1″ bolts and nuts.

Cast steel clamps right and left, for training gear with pin and

split pin. Cast-steel bracket, right and left with two ·75″ cheese headed bolts and hexagonal nuts, metal stud and wrought-iron guide piece, clamp screw, one right hand and one left hand thread with handle.

The rear end of the left hand piston rod is secured in a bracket bolted to the slide, as in the 6″.

A hole is drilled in the bracket for the valve of the piston rod, A plate is fixed on this bracket and also on the lug securing the front end of the right hand piston rod having the following inscription "cock closed when firing, open for running in."

Running in gear.

A small double-acting force pump is fitted on the right side of the slide at the rear.

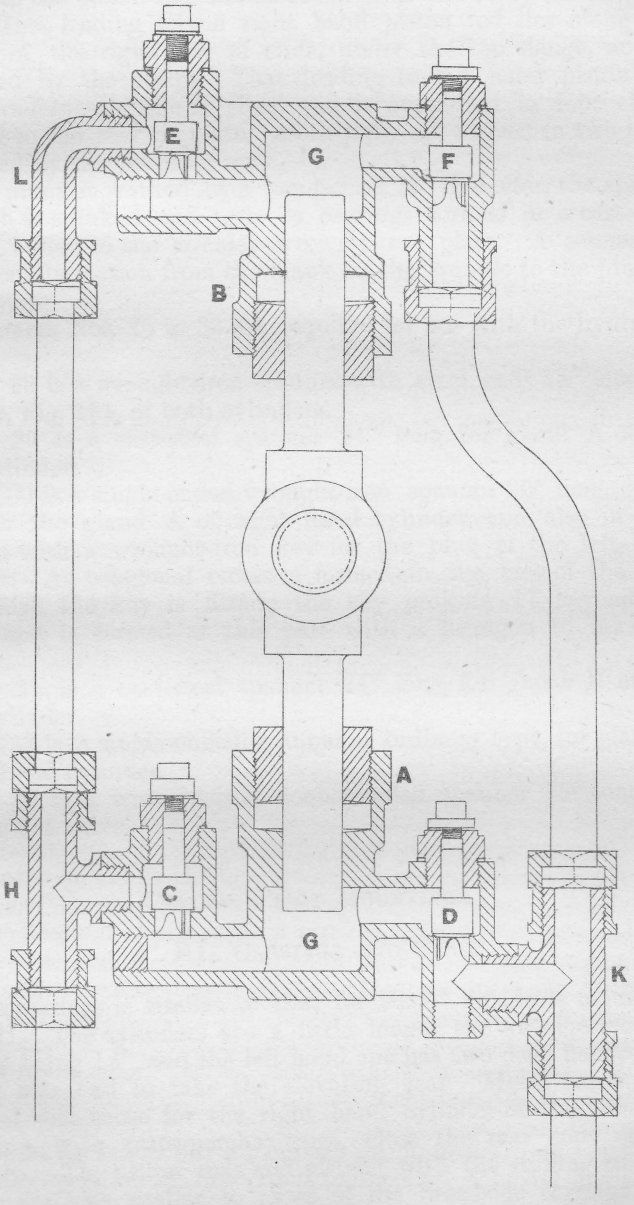
The pump and gear, Plate LVII, consists of the following parts:—

One circular wrought-iron plate with six screws.
One guard, cast-steel, with two bolts and nuts.
Two pump barrels of metal A, B, each with one metal gland, two valves, two metal and two steel plugs and three connecting screws.
One plunger, metal.
One connecting rod, wrought-iron, with two caps and four bolts and nuts.
One crank, wrought-iron, with washer and pin.
One handwheel for crank, iron, 33″ diameter, with wrought-iron handle in brass ferule and nut.
One elbow piece, metal, L.
Two pieces, metal, H, K.
Two copper pipes connecting valve on each side, each with two metal coupling nuts.
One pipe connecting right hand piston rod in two parts, with three coupling nuts, metal, four clasps, wrought-iron, and five studs screwed and nuts.
One pipe connecting left hand piston rod in two parts, with three coupling nuts, metal, five clasps, wrought-iron, ten studs and nuts.

The circular wrought-iron plate is attached by screws to the outside of the rear end of right side of slide; and the pump barrels, A, B, are attached by screws to the plate. The plunger works through a stuffing box in each barrel into a chamber G. In the upper part of this chamber an air cock, not shown in the drawing, has been fitted. Cotton packing is placed in the stuffing box, and a metal gland screwed on to it. The plunger is worked by the connecting rod, the upper end of which is attached to the crank. The crank rests in bearings formed in the guard which is bolted to the circular plate, and has the handwheel secured on its outer end.

The pump barrel forms casings for the valves C, D, E, and F, of which D and F are suction, and C and E delivery valves. D and F are connected by copper pipes with the left, and C and E with the right hand piston rod. A metal plug is screwed into each

To face page 448.




Uangerfield, Lith. 22, Bedford St. Covent Garden.

valve casing to form a bearing for the shank of the valve, a steel plug closing the top of the metal plug.

The metal T pieces, H, K, are screwed into the casings of the valves C and D, and the elbow piece L into that of the valve E.

H and L are connected together by a copper pipe, and K is similarly connected with the casing of the valve F. The pipes leading to the piston rods are attached to K and H by the coupling nuts. That leading to the right hand piston rod lies along the outside of the right side of slide, under the top flange, and is supported by the clasps. That leading to left hand piston rod passes underneath side of slide, and is supported in four clasps attached to the rear tie plate. Both pipes are formed in two parts connected by the coupling nuts.

The pump is worked by a handwheel 33″ diameter, the spindle of which is cranked and rests in bearings formed in a cast-steel bracket, bolted to the circular wrought-iron plate. A connecting rod transmits motion from the crank on the spindle to the plunger of the pump.

Spanners Nos. 28 to 33 are required for use with the hydraulic buffers.

No. 28 is a wrought-iron spanner with steel ends 14″ long, for glands *c*, Fig. 151, of both cylinders.

No. 29 is a cast-steel spanner 24″ long for gland A of left hand cylinder.

No. 30 is a single-ended wrought-iron spanner 20″ long. It is used for the gland A of right hand cylinder, and also in conjunction with a wrought-iron key for the plug of the left hand cylinder. An octagonal recess is formed in the face of the plug, into which the key is fitted; the key projects 1″ beyond the recess, and is formed at this part with a hexagon to take the spanner.

No. 31 is a cast-steel spanner 24″ long, for gland B of left hand cylinder.

No. 32 is a single-ended spanner of ordinary type, for gland B of left hand cylinder.

No. 33 is a wrought-iron double-ended spanner 15″ long for running-out valve.

## Central Pivot Mountings.

### 4″ B.L. Carriage and Slide.

The carriage is similar to that for the 4″ broadside mounting, Mark II. The cylinders are a little longer, the average recoil in practice being 13″, and the left hand one has two deep flanges cast on the rear end to take the elevating gear. Metal screw caps identical with those for the right hand cylinder of the broadside mounting, with gutta-percha rings, close the rear ends of the cylinders. The piston rods and pistons, with the stuffing box and glands, are also similar to those of the broadside carriage; the

The carriage

total length of the piston rod is 35·055″. The screw plugs for the emptying hole in the transoms are of wrought iron. There is also an emptying hole, at the outside of the right cylinder in front, closed by a screw plug.

The elevating gear is fitted to the left side similarly to that for the 5″ Broadside, Mark I. It consists of the following parts:—

A steel arc, same as for broadside mounting, giving 20° elevation and 14° depression.
A steel pinion, 12 teeth, 3·82″ diameter, fixed to steel spindle, 1·5″ diameter, by a key, solid with the spindle, and a ·375″ screw halved into the pinion and spindle; with two wrought-iron nuts and split pin.
A metal worm wheel, 24 teeth, 4·76″ diameter.
One pair of steel friction cones with wrought-iron nut.
Metal worm, 2·6″ diameter.
A steel worm spindle with metal hand wheel, two nuts ·5″ thick and split pin, one screwed collar with split pin, and one sliding collar with split pin and chain.
A metal elevating bracket with two ·75″ tap bolts.
A front bracket of metal for elevating gear with wrought-iron nut. This bracket is attached to the slide.
A gunmetal pointer with two ·5″ steel tap bolts.

**The slide.**

The slide consists of two girders of cast steel, the upper surfaces of which are planed and have a slope of 15°. They are connected by two transoms and a bolt with a distance quill; the front transom of angle steel is riveted across the front of the girders; the centre transom of cast steel is riveted to the slide by means of circular flanges cast with it. The bolt passes through the girders near the front. At the front end of each girder two brackets are cast to which a shield is secured by means of bolts, a pad of teak being placed between the brackets and shield to lessen the shock on the brackets should the latter be struck. The shield is further secured to the slide by means of plate and angle iron bolted to a flange on the girders near the front. On each upper bracket is a boss to which the piston rods are secured in the same manner as the broadside slide.

The centre transom forms a step bearing for the pivot, a bracket for the worm shaft of the training gear, and one for the front roller axle, being cast with it. A wooden cover fixed by four ·5″ tap bolts is placed over the centre of the transom to cover the pivot. The slide is supported on three coned rollers of steel, bushed with gunmetal, 5″ greatest diameter, one in front and two in rear. The front roller axle is of steel, 1·75″ diameter; it rests in a bearing formed in the centre transom, and is secured by a ·375″ tap bolt passing through a lug on the head of the axle and screwing into the transom.

The rear rollers rest on steel axles in flanged feet cast on the rear end of the side frames; the axle is 1·75″ diameter with cheese head. It is prevented from turning by a small pin fitted

into the clip plate, the end opposite the head being screwed, and a nut securing the axle and clip plate in their places. Lubricating holes are drilled obliquely through each axle and closed by screws. The rollers run on a pivot plate to which the slide is held down by four cast-steel clip plates. The rear clip plates are secured to the flanged feet of the rear rollers by means of the axles and nut, and also by ·875″ tap bolts, one to each plate. The front clip plate is lipped and hooks on to the slide, a ·875″ bolt and nut securing it in its place.

The pivot plate is of cast steel, having a racer for the coned rollers and a clip racer formed with it. It is bolted to the deck by twelve 1″ bolts. A gunmetal worm wheel ring is secured on the plate by set screws.

Training gear.

The training gear is fitted to the right side only, and consists of the following parts:—

A worm of forged steel, 5·1″ diameter; a ·625″ hole is tapped in it, a lifting bolt with loop head being provided for lifting the worm out of its place.
A training worm shaft of steel, 1·75″ diameter, with metal clamping nut, screwed collar and split pin, also washer, nut, and split pin.
A cast-steel wheel, 25 teeth, 9·947″ diameter.
An intermediate cast-steel wheel, bushed with gunmetal, 22 teeth, 8·753″ diameter.
A steel stud, 1·75″ diameter, for intermediate wheel, with wrought-iron nut and split pin.
A cast-steel pinion, bushed with gunmetal, 15 teeth, 5·969″ diameter.
A steel stud for pinion, 1·5″ diameter, with wrought-iron nut and split pin.
A steel cover for training wheels with four ·5″ tap bolts.
A metal cover for worm box with four ·375″ tap bolts.
Hand wheel of M.C.I. with handle, cotter and loop head set screw.

The worm shaft rests in metal-bushed bearings in the right hand girder and the centre transom. The bushes for the transoms are flanged, and prevented from turning by steadying pins on the flanges, which enter holes in the transom. The bush on the side frame is also prevented turning by a steady pin. The shaft is secured by a collar nut and pin on its left end. The worm fits on the worm shaft, between its bearings in the transom; it gears with the worm wheel ring on the pivot plate. The metal cover is secured on the transom over the worm by the bolts.

A wheel fits on the shaft outside the girder, and the clamping nut and collar are screwed on outside this wheel; the collar is secured by the split pin.

This wheel gears with the intermediate wheel, which gears with the pinion on the sleeve of which the handwheel is secured by the set screw.

Two eyebolts of iron on each side.

Fittings.

Two iron hooks riveted to right side for iron handspikes.

A metal bracket for extractor fixed by two screws to the rear of the right side.

A metal bracket for rimer, fixed by three screws to the right side.

A metal inscription plate fixed by two screws to the right side giving the register No. and weight of the slide.

A buffer stop is fixed on the inside of each side frame at the front as in the broadside mounting.

The metal retaining pawl and iron handspike are also similar to those for the broadside slide.

Spanners No. 7 and No. 9, Mark II, are required for use with the hydraulic buffers, the former for the plugs of the filling and emptying holes, and the latter for the glands and caps.

A spanner is also required for use with the elevating gear, p. 410.

A screwed loop is required for lifting the worm.

## 5″ B.L. Carriage and Slide.

Carriage. § 5105.

The carriage is similar in all respects to the 5″ Broadside, Mark I, with the following exceptions :—

The loop instead of being on the side of each cylinder as in the Mark I is on the top of each cylinder as in Mark II.

The sliding worm spindle is longer, its total length being 62·65″.

Slide. § 5105.

The slide is generally similar to the 4″ central pivot. The front transom is of bulb steel.

The shield consists of a vertical steel plate 1·25″ thick, bent round so as to protect the front of the gun, its greatest width is about 5′ 11·25″.

A port is cut out at the centre for the chase of the gun.

A top-plate of steel ·75″ thick is riveted by means of angle steel, to the bent plate ; its rear edge is straightened by angle steel riveted to it.

The shield is attached as in the 4″ C.P. but is also secured to a flange cast with a centre transom.

The three steel rollers on which the slide rests are 6″, greatest diameter, and are bushed with gunmetal. The front roller axle is 2″ diameter, with loop head, it is secured in position by a set screw, with loop head for a tommy passing through the flange of the bracket ; a shank on the set screw enters a hole in the axle. The rear rollers and clips and also the front clips are secured as in the 4″ C.P.

The training gear consists of the following parts :—

A worm of forged steel 5·1″ diameter provided with a tapped hole and lifting loop as in 4 C.P.

A training worm shaft of steel 2″ diameter with wrought-iron nut, 2·75″ long and ·375″ pin also with metal washer, wrought-iron nut and split pin.

A cast-steel wheel, 30 teeth, 11·938″ diameter.
A cast-steel intermediate wheel, bushed with gunmetal, 30 teeth 11·938″ diameter.
A steel stud 2″ diameter for intermediate wheel with nut and split pin.
A cast-steel pinion bushed with gunmetal, 15 teeth, 5·969″ diameter.
A steel stud for pinion 1·5″ diameter with nut and split pin.
A steel cover for training wheels with three ·5″ tap bolts.
A metal cover for worm box with four ·375″ tap bolts.
Handwheel of M.C.I. with handle and two loop headed set screws.
The arrangement of the gear is similar to that for the 4″ C.P.

Fittings.

Two eyebolts of iron on each side.
Two iron hooks riveted to left side for iron handspike.
An iron loop for outer gland spanner riveted to inside of left side.
An iron hook riveted to inside of left side for training worm lifting loop.
Two iron hooks for inner gland spanner riveted to outside of left girder.
Two iron hooks for filling plug spanner riveted to outside of left girder.
A buffer stop is fixed on the inside of each girder at the front. It consists of a spiral spring, buffer spindle, two nuts and split pin.
Metal brackets on outside for tube box and rimer, and on rear of right side for extractor.
A metal inscription plate giving registered number and weight is fixed on left side.
A metal retaining pawl is pivoted on the end of a stud riveted into the side of the left girder near the front. The pawl is secured on the stud by a washer and split pin, and is kept in action by a stop pin with bent handle attached to the left girder by a chain. The pawl rests on the pin which is inserted in a hole in the side. When the pawl is not in action it rests on a stop riveted to the side.
The following stores are required with the mounting :—
Iron handspike.
Spanner, hydraulic buffer, No. 7, for plugs of filling and emptying holes; No. 9 Mark II for inner gland and cap ; No. 10 for outer gland.
Spanner for elevating gear p. 410.
Loop screwed lifting worm.

## 6″ B.L. Carriage and Slide.

Carriage.

The carriage consists of two cylinder brackets connected by a hollow transom, the whole formed in one steel casting. The transom forms a stop to bear against the front buffers of the slide on the carriage running out. Trunnion bearings are formed in each

bracket with metal capsquares similar to those of the broadside carriage.

The carriage is kept in position on the slide by clips along each bracket on both inside and outside, which form part of the casting.

Two liners of manganese bronze are riveted to the under side of each bracket.

The general arrangement of the hydraulic buffers is similar to that in the 6″ broadside carriage; one piston rod being in tension, and the other in compression during recoil. The piston consists of two collars, forged solid with the rod, the rotating valve working between them. The valve is made in two pieces secured together by screws.

The cylinders are lined with tubes of forged steel; the left hand tube has a solid end in front, and is closed by a metal plug in rear. The valve box is screwed into the rear end of the right hand tube, and the front end is recessed to form a stuffing box. The packing for both cylinders consists of a cup leather, inner steel gland, cotton packing and outer metal gland as in the 6″ broadside.

The cylinders are connected in rear by a copper pipe with a collar brased on each end, curved so as to lie along the rear of the transom communicating with the right hand cylinder through the valve box, and with the left by a flanged metal pipe, which is attached by three screws. The copper pipe is attached to the valve box by a steel screw, and to the metal pipe by a metal nut.

The arrangement of the valves is similar to that for the 8″ broadside, page 444.

The parts are as follows:—

A metal valve box.
A metal running-out valve.
A steel spiral spring.
A metal cap.
A metal by-pass valve, with metal handle and split pin.
A leather ring and leather washer.
A metal gland for by-pass valve.

The ends of the piston rods are secured to the slide, and the buffers are filled and emptied as in the 6″ broadside.

The elevating gear consists of the following parts:—

An arc of wrought steel.
An elevating pinion of cast steel, 12 teeth, 4·78″ diameter, with spindle, four metal friction rings, spring washer, nut, and split pin.
A worm wheel of metal, 24 teeth, 7·64″ diameter, with two steel friction rings ·4″ thick, and three ·25″ thick.
A worm of metal.
A sliding worm spindle of steel, total length 44·31″, with steel cotter.
A handwheel of metal, 16″ diameter, with wrought-iron pin for handle, nut and metal quill.
An elevating bracket of metal, which also forms a cover for

the worm and worm wheel, with three countersunk screws, ·625″ diameter, and one tap bolt 1″ diameter.

The arc is rigidly attached to the gun, and gears with the elevating pinion, the spindle of which passes through a hole near the rear of the left hand bracket and also through the elevating bracket, which is bolted to the side of the carriage. The friction rings are placed on the end of the spindle; one thick ring being next the carriage bracket, then the metal and thinner steel rings are placed alternately, and lastly the other thick steel ring.

The arrangement of the worm, worm wheel, and sliding spindle is similar to that on the broadside carriage.

Slide.

The slide consists of two girder sides of cast steel, each formed with a bottom plate cast with it, with flanges front and rear. The flanges are bolted together with ·875″ bolts. The bottom plate of each girder is provided with a deep semi-circular flange; where the girders are bolted together these flanges form a bearing for the pivot. The slope of the slide is 10°.

Three rollers are placed in a recess in the upper part of the right hand girder, and four in a similar recess in the left; they are of cast-iron, bushed with metal, 7·8″ diameter. In each roller there is a tapped hole, which enables it to be lifted out by a screwed rod with loop handle. Each roller rests on a steel pin, 2·5″ diameter, which passes through holes in the girders, and is secured in position by a tap bolt, ·625″ diameter, passing through a hole in a lug formed on the head of the pin. An oil channel is cut on each side of the pin, and a hole drilled through the pin connecting the channels; the lubricating hole proper is drilled through the head to meet the first hole, so that oil can flow to either channel.

The girders are supported on four coned rollers of cast iron, greatest diameter 9·464″, bushed with gunmetal. The pins or axles of the rollers are of steel, 2·5″ diameter; they rest in flanged feet cast on the girders, studs on the pins fitting in recesses in the outer flanges.

A clip plate is attached to the inside of the outer flange and foot of each roller by a tap bolt 1″ diameter, which passes through the flange into a tapped hole in the plate. A tommy hole is made in the head of the pin to enable it to be turned if necessary in putting it in position. It is secured by a ·625″ split pin.

The training gear is similar to that for the 4″ and 5″ C.P., but there are two trains of spur gear, one on each side of the slide.

The gear consists of the following parts:—

A training worm shaft of steel.

Two cast steel wheels, 30 teeth, 11·938″ diameter.

Two cast steel intermediate wheels bushed with gunmetal, 36 teeth, 14·33″ diameter.

Two steel studs for intermediate wheels, with nut and split pin.

Two cast steel pinions bushed with gunmetal, 15 teeth, 5·97″ diameter.

Two steel studs for pinions with nut and split pin.
Two steel covers for training wheels, one right hand and one left hand.
Two handwheels of M.C.I., 30″ diameter.
A wrought-iron cover for pivot plate, chequered with six ·5″ tap bolts.
A metal cover for worm box, with four ·5″ tap bolts and two metal lubricating plugs.
The gear is fitted as in the 4″ and 5″ C.P.

The pivot plate is similar to those for the 4″ and 5″ C.P., but a well is formed in it between the pivot and racer, which is covered by a wooden deck.

A shield is attached to the slide at the front by four 1·125″ bolts, holes being drilled to suit at the front of each side. The shield is also attached to the side of each girder by a steel plate with two bars of angle steel, riveted to the plate, and secured to the shield and slide by ·875″ bolts.

The shield consists, as in the 5″ C.P., of a front plate 1·25″ thick, and a top plate ·75″ thick, both of steel.

Fittings.

Buffer stop at front of each side frame consisting of an iron spindle with head, secured by two nuts and a pin, and a volute steel spring.
An iron eyebolt on each side.
On the right side:—

Bracket for tube box.
„ for rimer.

On the end of the right side:—

Bracket for extractor.
„ for vent head.

Two hooks for handspike on inside of right side.
Two brackets for loading tray on left side of shield.
Two brackets for releasing lever for breech screw of gun on right side of shield.
The following stores are required for use with the mounting:—
Loop for lifting roller.
Lever brake nut.
Funnel with strainer for filling cylinder.
Spanner No. 16 for gland, valve box, cap and by-pass valve.
„ No. 17 for nuts of piston rods.
„ No. 19 for plugs of cylinders and valve box.
„ No. 20 for glands of cylinders.

§ 5137.

The loop for lifting rollers is a bar of round iron, ·5″ diameter, bent into a loop at one end and screwed at the other. Total length, 7·5″.

Lever brake nut.

The lever brake nut is of wrought iron, 1″ diameter, and 16·5″ long, formed with an eye at one end.

Spanners.

The spanners, &c., are contained in an implement box, generally similar to that for the broadside mounting, but differing in dimensions and internal arrangements.
It is 3′ 3″ × 12·5″ × 10·25″.

# CHAPTER V.—BOAT CARRIAGES AND SLIDES.

The following are the carriages and slides for boat service:—

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | tons. |
| R.M.L. | | | | |
| 9-pr. 8 cwt. wood carriage .. .. .. | 2 | 3 | 20 | 0·335 |
| ,, ,, slide .. .. .. | 4 | 2 | 25 | 0·310 |
| 9-pr. 6 cwt. wood carriage .. .. .. | 2 | 3 | 8 | 0·294 |
| ,, ,, slide .. .. .. | 4 | 2 | 0 | 0·277 |
| 9-pr. 8 cwt. or 6 cwt. iron carriage .. .. | 2 | 2 | 16 | 1·059 |
| ,, ,, slide .. .. | 4 | 3 | 0 | |
| 7-pr. 200 lbs. iron carriage, Mark I. .. .. | 1 | 0 | 21 | 0·077 |
| ,, ,, ,, ,, II. .. | 1 | 1 | 12 | 0·077 |
| ,, ,, slide .. .. .. | 2 | 1 | 17 | 0·257 |

## 7-PR. R.M.L. STEEL GUN OF 200 LBS. CARRIAGE AND SLIDE.

7-pr. R.M.L. steel gun of 200 lbs. carriage and slide. Mark I.

Mark I carriage, Fig. 152, consists of two brackets of $\frac{1}{4}''$ plate riveted to a bottom plate by means of angle iron on the outer sides and connected in front by a transom of plate riveted to angle iron, and in rear by another transom of angle iron. The capsquare keys are of steel.

It is fitted with two outside clips on each side, with a handle on each bracket, and with a square threaded elevating screw, with crutched head for attachment to the cascable of the gun, the nut of the screw is fitted with cross handles and oscillates in a metal pedestal bolted upon the bottom plate. A block for a wadhook worm is fitted upon the breast of the carriage.

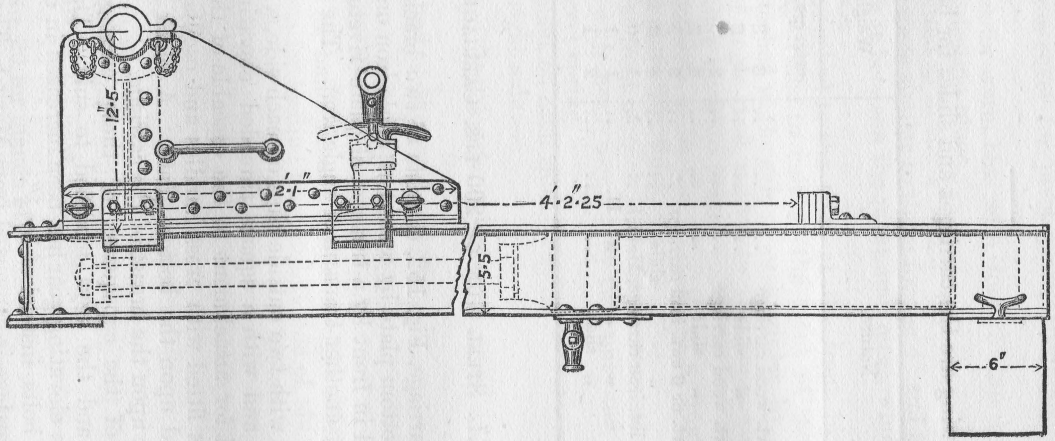
The lugs of the capsquares of these carriages have been strengthened and the keys modified to suit. The base of the pedestal of the elevating gear has been increased in dimensions and secured by $\frac{5}{8}''$ bolts, instead of by $\frac{1}{2}''$.

§ 4942.

Mark II carriage is converted from Mark I. The elevating gear is strengthened; the pedestal is replaced by two metal bearings, which are bolted to the bottom plate, and to an additional steel angle plate; a metal handwheel is fixed to the elevating nut in place of the cross handle; and the tumbler in which the nut works is increased in size.

The carriage is strengthened by increasing the thickness of the angle and clip plates and making them of steel instead of iron.

Fig. 152.



The bottom plate is also stiffened by the addition of two steel angle pieces.

The existing loops are replaced by others $\frac{3}{8}$″ longer in the stem, to admit of their being bolted through the additional angle cross pieces.

The slide consists of two sides of girder iron $5\frac{1}{2}$″ deep, bent round in front and joined by a connecting plate, three bottom plates, and a rear transom; the latter has a wooden block placed in front of it between the sides for the buffer to bear against. In the front bottom plate there is a hole for the fighting bolt and upon the upper surfaces of the side stops are fixed for the carriage, the rear stops having india-rubber plates attached to them. Slide.

The buffer is secured by bands upon the rear and centre bottom plates, nutted beneath; upon the outside of the right side of the slide a staple to hold a spanner for the buffer is attached. The holes in the piston are ·65″, and the recoil allowed is $26\frac{1}{4}$″. The working quantity of oil is 7 pints.

A run-off cock and guard, similar to those for the 9-pr. R.M.L. iron slide, Plate LVIII (p. 460), is substituted for the cock shown in the figure; the screw in the plug of the cock having a left-handed thread.

### 9-pr. R.M.L. of 6 cwt. Wood Carriage and Slide.

The carriage is converted from that for the 12-pr. R.B.L. It is a wood sliding carriage of the ordinary type, fitted with an elevating screw, working in a cross handled nut, with gudgeons, which oscillate in bearings attached to a plate on the rear block. The screw allows of 11° of elevation and 2° depression being given to the gun.

The carriage is fitted with two outside clips on each side with a bracket for the piston rod of the hydraulic buffer, and with a metal bracket to hold the wadhook worm on the front transom.

The slide is converted from the Mark II slide for the R.B.L. 9-pr. The slide.

It consists of two sides connected by three transoms; it has no rollers, but is fitted with friction plates and has a supporting block under both front and rear, hinged by keys and secured by hooks. In the front transom there is a hole for a fighting bolt by which the slide is pivoted.

### 9-pr. R.M.L. of 8 cwt. Wood Carriage and Slide.

This carriage is converted from that for the 12-pr. R.B.L.; it is generally similar to the preceding, but will only admit of 9° elevation and 2° depression.

The slide is fitted with a hydraulic buffer, which rests upon the front and centre transoms and is secured by bands passing through the transoms and nutted beneath. The rear cap rests against a bearing plate bolted between the rear extremities of the sides.

The internal diameter of the cylinder is 4″; holes in piston ·625″ diameter; working contents 5 quarts. The recoil is 2′ $11\frac{1}{2}$″.

The slide is similar to the preceding, it is converted from either the R.B.L. 9-pr., or 12-pr. slide, Mark II.

The diameter of holes in the piston of the buffer is ·625″; working contents 6 quarts.

To enable the gun to be worked upon a central pivot, the centre transom plate is fitted for a fighting bolt; the latter is arranged to be inserted from below, so that it will clear the buffer, and has a feather upon it to pass through a corresponding featherway in the transom and friction plate.

## 9-PR. R.M.L. OF 8 AND 6 CWT. WROUGHT-IRON CARRIAGE AND SLIDE, MARK I.

9-pr. R.M.L. wrought-iron carriage and slide. Mark I. L. of C., § 2874. (Pl. LVIII.

The carriage and slide are of similar construction to those for the 7-pr. steel gun of 200 lbs.

The brackets of the carriage are of $\frac{5}{8}$″ plate, and have a narrow stiffening piece along the front and upper edges, an eye in each of the rear clips, and breeching bouches; there are no handles. Drainage holes are made in the bottom plate. The elevating screw is similar to that of the 7-pr., and admits of 10° of elevation or 2° of depression being given to the gun. To adapt the carriage for the 6 cwt. gun also, a piece of angle iron is riveted across the bottom plate $4\frac{1}{2}$″ in front of the rear transom for the attachment of the brackets of the elevating gear.

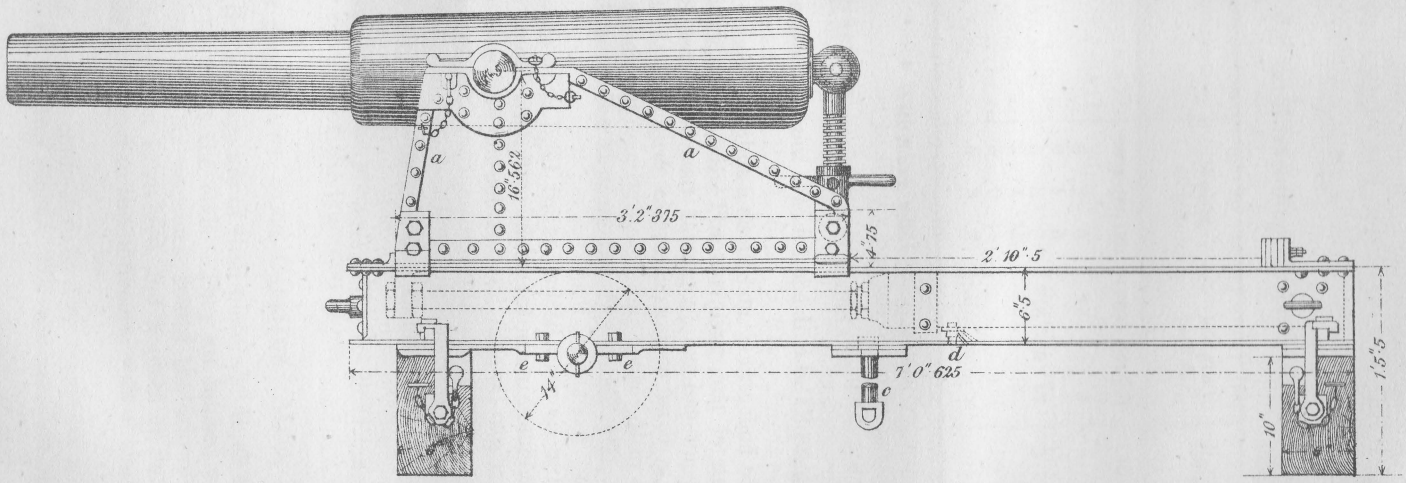
The girder sides of the slide are $6\frac{1}{2}$″ deep by $2\frac{7}{8}$″ wide in the flange; the three bottom plates, which with the rear transom connect the sides, have metal friction plates attached beneath them, the centre, as well as the front, being fitted for a fighting bolt, which, as in the wood slide, is inserted from below.

The slide has a handle in front, an eyebolt in rear at each side, and front and rear blocks; the transporting axle is secured in bands beneath the sides.

The hydraulic buffer is similar to that used for the 9-pr. R.M.L. of 6 cwt. wood slide, but the rear cap is formed with lugs by which it is attached to the transom, and the run-off cock is arranged to be contained within the depth of the slide, the screw in its plug has a left-handed thread, a guard for the cock is secured across under the sides of the slide. The holes in the piston are ·675″, and the working quantity of oil is 5 quarts.

# CARRIAGE AND SLIDE, WROUGHT IRON, COMPLETE,

## BOAT, M. L. R. 9 Pr OF 8 CWT (MARK I)




To face page 460.



DANGERFIELD LITH. 22. BEDFORD ST. COVENT GARDEN.

## CHAPTER VI.—TRAVELLING CARRIAGES.

The following are the naval travelling carriages:—

| Nature. | Weight empty. | Weight packed. | Tonnage. |
|---|---|---|---|
| | cwts qrs. lbs. | cwts. qrs. lbs. | tons. |
| R.M.L. | | | |
| 9-pr. 8 cwt. wood .. .. | 6 2 6 | 15 0 9 | |
| 9-pr. 6 „ „ .. .. | 6 1 2 | | |
| 9-pr. 8 cwt. and 6 cwt. steel .. | 6 2 7 | *15 0 13 | 1·324 |
| 7-pr. 200 lbs. iron .. .. | 3 1 16 | | |
| Gatling 0·45 .. .. .. | 4 0 14 | | 0·82 |
| Gardner 0·45 .. .. .. | 5 2 0 | | |

* With 8 cwt. gun.

### 9-PR. R.M.L. 8 CWT. WOOD CARRIAGE.

This carriage is converted from that for the R.B.L. 12-pr.; it is generally similar to that for the R.B.L. 6-pr., p. 21.

There are no axletree boxes, but a small box is attached to the left bracket over the axletree bed. The elevating gear is similar to that on the 9-pr. 8 cwt. wood boat carriages; but has the cross handles bent upwards to give more clearance, and is fitted with a thumbscrew to act as a clamp.

The wheels used with the carriage are Naval, No. 163, 3′ 6″ diameter.

The limber consists of a light frame bolted over an axletree bed, and fitted with a pole with two slats for man draught. It carries two long side boxes and one centre box. The oil can is fixed at the back of the centre box.

### 9-PR. R.M.L. OF 6 CWT. WOOD CARRIAGE.

This carriage is similar to the preceding, but the elevating screw is placed $4\frac{1}{2}$″ nearer the axis of the trunnion holes.

### 9-PR. R.M.L. OF 8 OR 6 CWT. STEEL CARRIAGE. MARK I.

9-pr. R.M.L. steel carriage. § 3780.

The brackets of this carriage are of steel plate, $\frac{7}{16}$″ thick in the middle, and tapering to $\frac{5}{16}$″ at the ends. They are housed over a solid steel axle of rectangular section; round the edge of the housing a piece of angle iron is riveted, and a piece of flat iron, bent to grasp the axle, is riveted to the horizontal web of the angle iron.

The brackets are further connected by two transoms, a collar bolt, a trail piece, and a bearing piece. The transoms are of steel

plate, turned over at the edges for attachment to the brackets; the front transom stands just in front of the axle, and is formed with a horizontal web to strengthen the attachment; the second transom is about 16″ in rear of the other, and is also turned over along its top edge.

The bracket plates are bent round to meet at the point of the trail, and are there connected by the trail piece which fits outside them, and by a bearing piece, also of steel, between them.

Tensile stays of wrought-iron connect the shoulders of the axle with the brackets at the position of the second transom.

They have eyes on their front ends which fit on cylindrical continuations of the bases of the arms; studs are formed on their rear ends, which fit into holes drilled in the bracket plates, to which they are each also attached by two of the rivets securing the transom.

The elevating screw is of the Whitworth pattern; the gudgeons of the box rest in metal bearings on the tops of the bracket plates, and are secured by caps; the screw is worked by a handwheel at the rear of the box.

There are two positions for the gudgeons in the metal bearings, so as to make the carriage suitable for either the 8 cwt., or 6 cwt. gun.

The carriage is fitted with a ring, shoe, and pin for the field service traversing handspike; with a metal socket for priming wires, and with fittings to carry a billhook, handaxe, &c., also with the same axletree box as that of the wood carriage.

The sponge is carried on the right bracket, and the handspike on the left; they rest in supports which are made strong enough to act also as locking plates, and are further secured by straps.

The spare sponge and handspike are carried underneath, resting in supports between the brackets near the point, and secured by straps under the axle.

The wheels are naval, No. 56, with second class B pipes, 3′ 6″ diameter.

§ 3785. The limber consists of a frame of angle iron, with T iron summers, a cross plate, a limber hook and socket for pole draught.

The frame is attached to an axletree by a stay on each side, and is fitted to carry two side boxes, one centre box, and the entrenching tools.

The axletree is formed with lugs for its attachment to the plate iron stays of the frame.

The pole with slat is similar to that for the wood limber.

The ammunition boxes are each fitted to carry twelve rounds and a proportion of small stores.

The centre box is of the same height as the ammunition boxes, and the partitions are arranged to carry cylinders containing fuzes and friction tubes, and a proportion of spare pistol ammunition.

### 7-PR. 200 LBS. IRON CARRIAGE.

§ 3833. This carriage is similar to that for mountain service, page 108

it differs from the latter in the length of the axletree, which is 3″ longer, and in the special fittings for side arms.

The body of the limber is similar to that for mountain service, but is made large enough to carry two leather ammunition boxes and one wood box for small stores.

The leather boxes are similar to those for mountain service, but are not fitted with links for attachment to packsaddles.

The wheels are naval, No. 58, 3′ diameter.

## ·45″ Gatling Carriage.

·45″ Gatling gun carriage and limber. Mark I. L. of C., § 2643.

This carriage resembles the field service Gatling carriage in the general form of the body. The brackets are of ½″ plate; they are riveted to the axletree, and further connected to it, each by a stay of round iron; they are united by three collar bolts in their length, and at their points by a trail piece which lies between them, and has the usual eye formed in it; to give increased bearing on the ground a small piece of angle iron is riveted to each side of the point of the trail.

The axletree is solid, its body bent down at the centre, to receive a bed upon which the gun lies.

The bed consists of a wrought-iron pedestal, the lower end of which rests upon the centre of the axletree, while a spindle projecting from it passes through a hole in the latter, and is secured by a clamping screw. Upon the upper end of the pedestal, in the direction of the longitudinal axis of the carriage, a bearing plate is bolted, to the under side of which a vertical quadrant or elevating arc is attached. The arc has teeth on its edge, in which an endless screw worked by a handwheel gears, so that by working the screw any required elevation or depression can be given to the bearing plate, and consequently to the gun above it. A screw is added to clamp the arc, for the purpose of keeping the gun steady. To admit of lateral motion being given to the gun, another bearing plate is placed upon the first, pivoted to the latter in front, and having a pin projecting from it working in a circular slot in the latter to the rear. To give motion to the upper or trunnion plate, to which the gun is bolted, a worm wheel is attached to the upper end of the pin just mentioned above the plate, and a pinion to the lower end beneath the under plate. The worm wheel is worked as desired by an endless screw with handwheel upon the upper plate at the left side, while the pinion gears into an arc attached to the under side of the under plate.

The point of the trail is fitted with an iron traversing handspike of the Indian pattern, and on the inside of each bracket there is a staple for carrying a cleaning rod.

The wheels are Naval, No. 57, 3′ 6″ diameter:—

§ 3708. Standard swivel.

A Mark II swivel standard has been approved; it differs from Mark I in having the following alterations:—

1. The base is enlarged to give greater bearing surface.
2. The sides of the standard are widened to form a steadier

guide for the elevating arc, which is rigidly attached to the bed plate.

3. The elevating spindle and bearings, and all working parts, are made with less clearance.
4. The worm wheel is enlarged at the base, and fitted with a metal guide block to work in the bed plate.
5. The top of the axletree of the carriage is faced to suit the increased base of the standard.

The limber consists of two futchells of angle iron let into and riveted to a box girder axletree bed, projecting beyond the latter in rear and attached to a trough iron splinter bar in front. The bed is formed of a cast metal frame and wrought-iron axle connected by wrought-iron plates; the limber hook is riveted to it in rear, and two stays of round iron are led from it to the splinter bar.

A platform board is secured across the futchells in front, and box staples fitted in it for the attachment of a limber box, which is further secured by a strap through a loop formed in the rear end of each futchell.

The wheels are the same as for the gun carriage.

The limber is fitted with a pole with two slats for draught, the pole having a prop for use when required.

The limber box is of deal, with elm ends, and plated with steel on the back and top; it is strengthened by an iron band which passes underneath and has a small eye formed in each end at the side of the box. The lid of the box opens at the rear and is secured by a hasp and turnbuckle. The box is fitted to carry six drums.

Beneath the limber are fittings to carry two boxes of S.A. ammunition between the axletree bed and splinter bar: upon the platform board and upon the lid of the box are staples with straps for securing stores.

§ 4276.

### 0·45″ Gardner Carriage.

This carriage is converted from the preceding, for the 0·45″, 5-barrel Gardner gun. The alteration consists in fixing a metal bracket above the centre of the axletree, and boring a hole through both to suit the standard of the Gardner gun. A clamping screw is fitted in front of the bracket to secure the standard.

§ 4234.

Four staples are fixed on the front of the axletree bed of the limber, to carry two leather pockets.

The ammunition box is increased in height to 12″ inside and the internal fittings are removed and rearranged so as to carry 34 Gardner feeders and a tray for spare parts.

## CHAPTER VII.—MISCELLANEOUS.

Axletrees, transporting.

The following axletrees are in the service, for transporting wood and iron slides on board ship.

| Nature. | Section. | Length. | | Weight. | | |
|---|---|---|---|---|---|---|
| | | ft. | in. | cwts. | qrs. | lbs. |
| FOR IRON SLIDES. | | | | | | |
| R.B.L. 20-pr. upper deck .. .. | | | | 0 | 1 | 12 |
| R.M.L. 8″ and 9″ .. .. .. | 4″ square | 6 | 11 | 2 | 3 | 17 |
| ,, 7″ 6½ tons .. .. .. | 3″ ,, | 5 | 9½ | 1 | 1 | 15 |
| ,, 7″ 90 cwt. .. .. .. | 3″ ,, | 5 | 4¼ | 1 | 1 | 4 |
| ,, 64-pr. Marks I., II., and III., and B.L. 6″ Armstrong .. | | | | 1 | 0 | 13 |
| R.M.L. 64-pr. Mark III. traversing and Marks IV., V., and VI. | | | | 1 | 0 | 6 |
| R.M.L. 9-pr. boat .. .. .. | 2″ ,, | 2 | 7 | 0 | 1 | 10 |
| FOR WOOD SLIDES. | | | | | | |
| R.B.L. 7″ and R.M.L. 64-pr. .. .. | 3″ round | 3 | 2 | 1 | 0 | 0 |
| R.B.L. 40-pr. .. .. .. .. | | | | | | |
| R.M.L. 9-pr. .. .. .. .. | 2″ ,, | 2 | 7 | 0 | 1 | 14 |

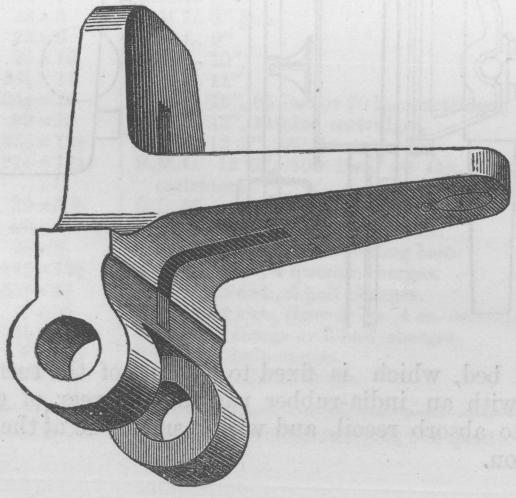
The above axletrees are fitted with linch-pins and washers.

Barrows.

The barrow for projectiles of guns under 10″ is formed of a frame of ash, with iron guard in front, and two metal trucks. For higher natures the barrows are the same as those used in land service.

Fig. 153.

Brackets, transporting.



Brackets, transporting.

These brackets are of metal or wrought-iron, and of the form shown in Fig. 153. They are used in transporting slides on board ship. The metal flap on the front of the slide is removed and replaced by the bracket, which furnishes a bearing for the roller handspike, the nib of which fits into a recess in its arm.

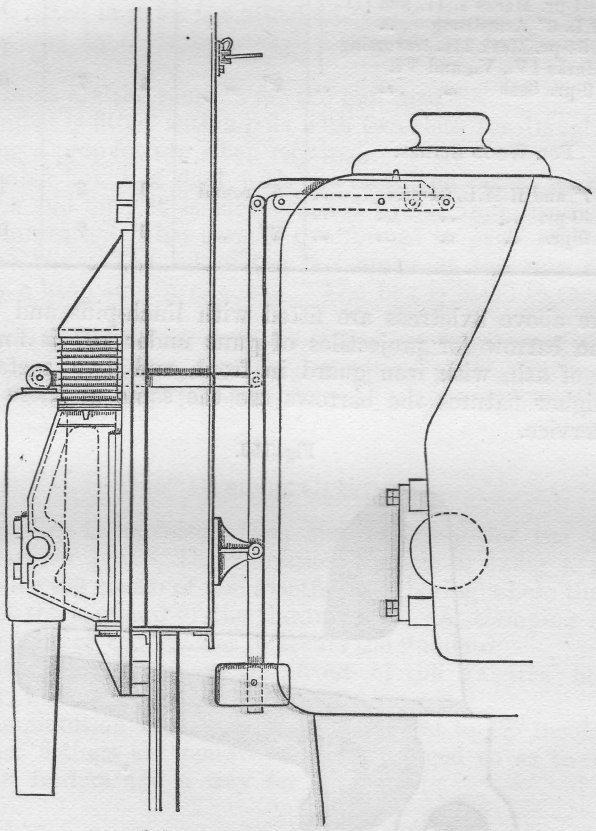
The following are the natures of these brackets in the service :—

B.L. 6″ Armstrong.
R.B.L. 20-pr. upper deck.
R.M.L. 8″ and 9″.
R.M.L. 7″ 6½ ton, and 90 cwt. and 64-pr.

Carriages for tops of turrets R.M.L. 9-pr. and 7-pr. § 3894.

The 9-pr. carriage, Fig. 154, will take either the 8 cwt. or 6 cwt. gun ; it is a wrought-iron single plate carriage supported on a

Fig. 154.



cast steel bed, which is fixed to the roof of the turret. The bed is fitted with an india-rubber pad at the rear of each carriage bracket, to absorb recoil, and with a small one at the front to take the reaction.

The cascable of the 9-pr. is connected with the turret gun by a counterweighted lever, with connecting bars, suspended inside the roof of the turret, so that any elevation or depression given to the gun inside is communicated to the gun on the top of the turret. When the gun inside the turret is required to be fired, the connection between it and the lever is removed.

The details of the connecting gear are special for each turret.

The carriage for the 7-pr. for 200 lbs. is similar to the above.

| | Weight. | Tonnage. |
|---|---|---|
| | cwts. qrs. lbs. | tons. |
| 9-pr. carriage with bed .. .. .. .. | 16 3 12 | 1·066 |
| Fittings .. .. .. .. .. | 3 1 16 | |
| 7-pr. carriage with bed .. .. .. .. | 5 1 22 | 0·593 |
| Fittings .. .. .. .. .. .. | 2 3 18 | |

Carriage, transporting.

This carriage is intended for transporting R.M.L. 7″, 8″, and 9″ guns on board ship; it consists of two wood bolsters on axletree beds, connected by three iron tie bars with an axletree let into each bed, and fitted with wooden metal bushed trucks, 8″ in thickness.

Cases, cartridge.

Leather cases for S.B., R.B.L. and R.M.L. guns up to the 80-pr. are similar to those for Land Service, and are numbered from 1 to 7.

Cases for R.M.L. guns 7″ and upwards, and for B.L., are of Clarkson's material, and are numbered from 8 upwards.

The following are the cases of this description in the service.

| No. | Internal dimensions. | Nature. |
|---|---|---|
| | inches. | |
| 8 | 24 × 7 | R.M.L. 7″ |
| 9 | 23 × 8 | R.M.L. 8″ gun. |
| 10 | 23 × 9 | R.M.L. 9″ |
| 11 | 29 × 10 | R.M.L. 10″ |
| 12 | 26½ × 11 | R.M.L. 11″ |
| *13 | 24½ × 12 | R.M.L. 12″, 85 lbs. or 70 lbs. cartridges. |
| 14 | 29 × 12 | R.M.L. 12″, 110 lbs. cartridges. |
| 15 | 35½ × 12½ | R.M.L. 12·5″, 130 lbs. cartridges. |
| 16 | 27½ × 12½ | R.M.L. 12·5″, 100 lbs., 80 lbs., or two 52½ lbs. cartridges. |
| 17 | 29 × 6 8/10 | B.L. 6″ gun. |
| 17A | 29 × 7 | B.L. 6″, 80-pr., with folding base. |
| 17B | 28 × 8 | B.L. 6″ Mark II, with folding base. |
| 18 | 44⅝ × 12½ | R.M.L. 12·5″, 4 quarter charges. |
| 19 | 20½ × 5½ | B.L. 4″ 22 cwt., 2 half charges. |
| 20 | 9 × 9⅜ | B.L. 4″ 13 cwt., three 3 lbs. 4 oz. cartridges. |
| 22 | 21 × 5¾ | B.L. 5″, 1 charge or 2 half charges. |
| 23 | 7 × 10½ | B.L. 8″, 1 half charge. |
| 24 | 21 × 11½ | B.L. 9·2″, 1 half charge. |

* § 5129. No. 13 case has been approved for carrying two quarter charges for 10″ B.L. guns.

The material of the above cases is composed of strips of cork cemented between two layers of canvas with indiarubber cement and covered on the outside with leather.

The latest pattern of cases Nos. 8 to 16 is Mark II. They are stronger than Mark I.

No. 8 case has a lid at one end, fitted with a flat leather handle, and attached to a long leather loop, along which it slides when taken off.

Nos. 9 and 10 are similar to No. 8.

No. 11 similar to No. 8, but is fitted with side handles.

No. 12 is similar to No. 11.

No. 13 is similar to No. 11, but the handle on the lid is rounded.

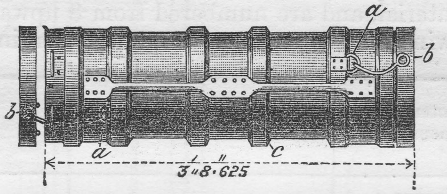
Nos. 14, 15, and 16 are similar to No. 13.

§ 4368. No. 17A. This case is fitted with a folding base, which permits the cartridge to be pushed directly into the gun, without being exposed. The lid is similar to that of No. 8.

No. 17B is similar to No. 17A.

§ 4256. No. 18, Fig. 155. Each end of the case is closed by a movable

Fig. 155.




cover, attached by a metal bayonet joint. At each end a lanyard covered with leather is spliced into a staple (*a*) on the case and round a knob (*b*) on the cover.

Two gunmetal studs are fixed on the outside of the case, by means of which the case may be locked to a loading trolly.

No. 19. The long loop on which the upper lid or cap slides is pivoted on studs fixed to the band round the case. A lower cap is also fitted to the case; it is hinged to the latter by a leather strap, and secured by a flap, which buttons on a metal stud on the lower end of the case. There are no side handles.

No. 20 is similar to No. 8, but the lid has a round handle.

No. 22. The loop pivots on studs like that of No. 19; the lower cap is secured by two flaps of leather, one attached to the cap, and one to the case, and a metal staple attached to the case. The flap

on the lid has a slot in it, which fits over the staple: the tongue of the flap on the case is then drawn through the latter.

No. 23. The upper loop does not pivot. The lower cap is secured like that of No. 22. The case is fitted with side handles.

No. 24. Is similar to No. 23.

Case, rocket.

The case is of Clarkson's material, and is similar to the cartridge cases. It is closed at one end by a lid; a strap with buckle is fitted endwise round the case, passing through two loops on one side of the case, one on the base, and one on the lid. The case is 23″ × 4″.

Case, tube box. § 4820.

This case is intended to hold tin boxes containing vent sealing tubes; it is of leather, lined with raw hide, and fitted with metal hasp and turnbuckle for fastening the lid. It is attached to a metal bracket on the carriage by two $\frac{3}{8}$″ metal screws.

Internal dimensions: length $7\frac{1}{8}$″, width $3\frac{5}{8}$″, depth $5\frac{3}{4}$″. Weight 1 lb. 13 ozs.

Ejectors, projectile, B.L.

Ejectors have been approved for the following guns, 12″, 9·2″ 8″, 6″, 5″, and 4″.

The ejector consists of a metal cup, shaped to suit the head of the projectile, and fitted on one end of a stave of ash. The other end of the stave is fitted with a metal screwed socket to receive the end of the lengthening stave.

The stave is fitted with a stop, consisting of a bar of gunmetal, which can slide along the stave, and can be secured by a set screw, in such a position that when the ejector is used, it may be stopped by the muzzle of the gun so as to prevent the projectile from being too forcibly ejected at the rear.

Handspike, common, 6′ naval, iron shod.

This is similar to the common handspike for L.S., but has a wrought iron plate attached by screws to the back at the point.

Handspikes, stop.

Stop handspikes are of ash 4′ long, each fitted with a metal stop let into and riveted in the end.

Levers, lifting joint.

Lifting joint levers are used for raising the pivot flaps of revolving slides, and are of two descriptions, viz., "common," for use with wooden slides, and "S-shaped," for use with iron slides. For R.B.L. guns the end of the lever serves as the tin cup extractor.

Magazine, boat.

The boat magazine is a small wooden box fitted with grummet handles, the lid covered with leather and secured by a spring lock. The interior of the lid is fitted with leather loops; a leather copper-bound case to hold cartridges and a leather case for tubes are carried in the magazine.

Measures, draw off, hydraulic buffers.

These measures, see Fig. 52c, page 193, are intended for drawing off from hydraulic buffers, after they have been filled, a sufficient quantity of oil to leave the amount of air space required. They are as follows:—

| | |
|---|---|
| 17½ pints | R.M.L. 10″ Sultan type. |
| 8 ,, | 12″ 25 tons and 9″ turret, and 12″ Belleisle type. |
| 6¼ ,, | R.M.L. 7″ 90 cwt. |
| 2 ,, | R.M.L. 12″ 35 tons turret, and 11″ Temeraire type. |
| 1¼ ,, | B.L. 4″ gun vessel, R.B.L. 20-pr., R.M.L. 9-pr., 7-pr., and 10″ gunboat. |

They are tin vessels with brass screw caps, and a handle at the side, except that for the 10″, which has two tinned wire handles hinged to the sides.

Pans, drip, hydraulic buffer. § 4028.

These pans are made of zinc; they are placed for purposes of nomenclature, in a numbered series, Nos. 1 to 10 being used for naval service. They are employed for the glands and run off cocks of the buffers of carriages and slides, as follows:—

| | |
|---|---|
| No. 1 | Gland R.M.L. 12″ Glatton, 11″ and 7″ 90 cwt; gland and run off cock 10″ turret; run off cock 10″ Hercules. |
| No. 2 | Run off cock, R.M.L. 11″. |
| No. 3 | Gland R.M.L. 12″ 25 tons Belleisle type, 10″ Sultan type. |
| No. 4 | Run off cock R.M.L. 12″ Belleisle type, 10″ Sultan type and 7″ 90 cwt. |
| No. 5 | Gland R.B.L. 20-pr. gun vessel, and R.M.L. 7-pr., run off cock 12″ 25 tons turret, and gland and run off cock 12″ 35 tons turret. |
| No. 6 | Run off cock R.B.L. 20-pr. gun vessel. |
| No. 7 | Gland and run off cock R.B.L. 20-pr. upper deck. |
| No. 8 | Gland and run off cock R.M.L. 9-pr. |
| No. 9 | Gland and run off cock R.M.L. 9″ turret. |
| No. 10 | Gland R.M.L. 10″ gunboat. |

No. 1 pan has a fixed cover with a hole in the centre, and in one corner a screw stoppered hole for emptying.

No. 2 has a cover similar to that of No. 1, and is fitted with a hanger for suspension from a screw.

No. 3 has a cover similar to that of No. 1, and is fitted with two jointed hooks for suspension from pins.

No. 4 has a cover similar to that of No. 1.

No. 5 has a cover similar to that of No. 1, and is fitted with a small wrought iron stud at each end.

No. 6 has a cover similar to that of No. 1, and is fitted with a small wrought iron stud at each end.

No. 7 has a cover similar to that of No. 1, except that it has no stoppered hole in the corner. It has a spout which is intended both for emptying the pan, and for catching the drip from the gland. It is fitted with two jointed hooks for suspension from pins.

No. 8 has a cover and spout similar to those of No. 7. It is fitted with a base plate, having two slots by which the pan is secured to existing bolts.

No. 9 has a cover similar to that of No. 1. It is fitted with jointed hangers, to suspend it from the run-off cock.

No. 10 has a cover similar to that of No. 1. It is fitted with hangers, to secure it to the front cap of the buffer.

These plates are of brass, each is engraved with a table of ranges and a corresponding scale to guide the setting of the fuzes, time and concussion, Armstrong medium. The plates corresponding to the mark of gun supplied is fixed to the mounting on board ship. The following plates have been made. Plates, fuze. § 5028.

4″ Mark I gun.
4″ „ II and III gun.
5″ „ I
6″ „ II
6″ „ III.

The side arms for naval service are generally similar to those for land service, see page 345. Side arms.

The following are special to S.S. (This table includes side arms of the new type B.L. guns, no mountings for which have as yet been approved for L.S.)

| Nature. | Weight of Sponge | Rammer | Wadhook | Gauge Staff | Remarks. |
|---|---|---|---|---|---|
| B.L. | lbs. | lbs. | lbs. | lbs. | |
| 12″ .. .. | 92 | 53 | | | |
| 9·2″ Bore .. | 45 | | | | |
| 9·2″ Chamber | 23 | 12¼ | | | |
| 8″ Bore .. | 37 | | | | |
| 8″ Chamber | 22 | 12¾ | | | |
| 5″ Bore .. | 17¾ | | | | |
| 5″ Chamber | 5½ | 7½ | | | |
| 4″22cwt. Bore .. | 11¼ | | | | |
| 4″22cwt. Chamber | 4 | 7 | | | |
| 4″13cwt. Bore .. | 9 | | | | |
| 4″13cwt. Chamber | 3½ | 6½ | | | |
| R.M.L. | | | | | |
| 16″ .. .. | 140 | 108 | 73 | 10 | |
| 12·5″ .. .. | 57 | 66¾ | 38½ | 6 | |
| 11″ .. .. | 28½ | 39½ | 17 | 5½ | |
| 9″ .. .. | 16 | 16 | 11½ | | |

The sponge R.M.L. 12·5″ differs from that for L.S. in the stave being fitted with a socket for the attachment of an end stave.

The rammer heads of the B.L. 9·2″ and 8″ are of elm, unbound, and secured each by a copper rivet ; they are flat ended. For the B.L. 5″ the head and stave are formed in one piece of ash: the head is bound with two copper hoops. The rammer for the 4″ is similar.

For the R.M.L. 12·5″ the rammer stave is fitted with a socket for the attachment of an end stave; loops are cast on the metal socket of the rammer stave, and a wrought iron band with loops for guide ropes is fixed on the end of the end stave.

For the R.M.L. 9″ and 8″ the rammers are fitted for bell ropes. The bell ropes are of 2″ white rope, each 18′ long, with a knot formed at the end; they are spliced into loops on a socket, which slides on the stave.

§ 4084. The gauge staff for R.M.L. guns consists of a wood staff with a wood ball at one end. Four metal plates are secured on the staff, each by two screws. The plates are engraved respectively, with the nature of the charge and projectile used, as follows:—

Battering charge, Palliser shell.
Full charge, common shell.
„ shrapnel „
„ case shot.

They are supplied separately from the staff, and are fixed on board ship as required.

Spanners, hydraulic buffers. As mentioned, page 347, these spanners have been placed in a numbered series. The following are the spanners for naval service:—

| | |
|---|---|
| No. 4 | Gland R.M.L. 10″ "Temeraire" type, 10″ gunboat, 7″ 90 cwt., 64-pr. 9-pr., 7-pr.; B.L. 4″ gun vessel, and R.B.L. 20-pr. |
| No. 5 | Gland R.M.L. 12″ "Bellisle" type, 10″ "Sultan" type, and "Temeraire" turret 12″ 35 tons, 25 tons, and 9″. |
| No. 7 | Plug and cock naval (except turret, 12″ 35 tons). |
| No. 8 | Plug and cock, turret, 12″ 35 tons. |
| No. 9 | Gland and cap, Vavasseur B.L. 5″ broadside, Mark II, 4″ broadside and C pivot, inner gland and cap, B.L. 5″ broadside, Mark I and C pivot. |
| No. 10 | Metal, outer gland. B.L. 5″ Vavasseur broadside, Mark I and C pivot. |
| No. 11 | Plug ⎫ cylinder, B.L. 6″ Vavasseur. |
| No. 12 | Gland ⎭ broadside and C pivot. |
| No. 13 | Gland screw, and adjusting screw, B.L. 6″ Vavasseur broadside. |
| No. 14 | Cap, left cylinder front end and valve box, B.L. 6″ Vavasseur broadside. |
| No. 15 | Plug, valve box, and screw adjusting height of lift, B.L. 6″ Vavasseur broadside. |
| No. 16 | Gland and valve box caps, and by-pass valve, B.L. 6″ Vavasseur broadside and C pivot. |
| No. 17 | Nut, piston rod, B.L. 6″ Vavasseur broadside and C pivot. |
| No. 18 | Air hole and run off plug, B.L. 6″ Vavasseur broadside. |
| No. 19 | Plug, cylinder and valve box, B.L. 6″ Vavasseur C pivot. |
| No. 20 | Gland, cylinder, B.L. 6″ Vavasseur C pivot. |

Spanners 4 and 5 have already been noticed, page 347. The spanners used with the Vavasseur carriages are described with the mountings for which they are respectively intended.

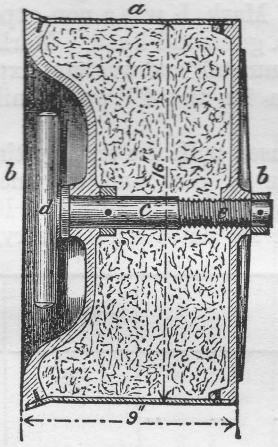
Nos. 7 and 8 are both similar to No. 6, but of slightly greater dimensions.

Swingletrees. The swingletree used with naval travelling carriages is similar to that for field service, but the hook is attached to an eye at the

centre by a rope strap covered with leather, the swingletree is 2′ in length.

The expanding tampeons for naval service are different to those for L.S. Fig. 156 represents the tampeon for the R.M.L. 16″. Tampeons.

Fig. 156.



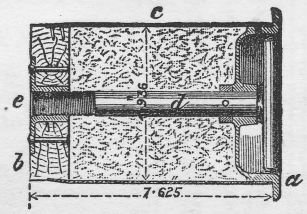

It consists of two metal plates (*b*, *b*,) connected by a leather casing (*a*), in the interior of which is a stuffing of horse-hair. A metal spindle (*c*) with handle (*d*), having a screw thread (*e*) at the end, draws the plates together, thus expanding the leather case so as to make it fit tightly in the bore of the gun. Strips of leather corresponding to the rifling of the gun, are sewn on the casing (*a*).

Weight 70 lbs.*

The tampeon for the B.L. 9·2″ is similar to the above, but the leather strips are dispensed with, and instead of a metal plate at the rear, it has a wooden disc to which the leather casing and a layer of fearnought placed over it, are attached by copper nails. A metal nut for the spindle is let into the disc and secured by copper rivets.

The following expanding tampeons are similar in construction,

Fig. 157.




B.L. 8″, 6″ Mark III, 5″ and 4″ Mark II. Fig. 157 shows a 5″ tampeon.

* Mark II tampeon is lighter than Mark I.

It consists of a metal plate (*a*) and a wooden disc (*b*) connected by a leather casing (*c*), the interior of which is stuffed with horsehair. A metal spindle with cross handle (*d*) has a thread cut on the end, which, working in a metal nut (*e*) let into the disc (*b*), draws the plate and disc together, so as to expand the leather case, and makes it fit tightly in the bore of the gun.

The 6″ tampeon, Mark I, was a non-expanding tampeon of the ordinary type, with a gunmetal knob. Mark II tampeon had both head and knob of gunmetal, and was non-expanding.

Mark I tampeon for the 4″ was similar to Mark I for the 6″.

**Trucks, transporting.**

These trucks are used with the transporting axletrees mentioned page 465. They are of elm, and are metal bushed, with the exception of those for the R.M.L. 9-pr. and R.B.L. 20-pr.

The following are the natures in the service:—

| Nature. | Diameter. | Thickness. | Weight. |
|---|---|---|---|
| | ins. | ins. | lbs. |
| R.B.L. | | | |
| 20-pr. upper deck .. .. .. | | | |
| R.M.L. | | | |
| 8″ or 9″ .. .. .. .. | 16 | 8 | 52 |
| 7″ .. .. .. .. .. | 16 | 8 | 51 |
| 64-pr. and B.L. 6″ .. .. | 14 | 6 | |
| 9-pr. boat .. .. .. .. | 14 | 4 | 11 |

# APPENDIX A.

## TABLE OF WEIGHTS AND TONNAGE OF TRAVELLING CARRIAGES.

| Nature. | Weight. Empty. cwts. | qrs. | lbs. | Weight. Packed. cwts. | qrs. | lbs. | Tonnage. tons. |
|---|---|---|---|---|---|---|---|
| **Ambulance carriages:** | | | | | | | |
| Wagon, ambulance, Mark II | 16 | 2 | 0 | — | | | 5·500 |
| „ „ Mark III | 17 | 3 | 6 | — | | | 3·625 |
| „ „ converted | 18 | 3 | 2 | — | | | 3·164 |
| „ pharmacy | 18 | 3 | 0 | 31 | 0 | 0 | 8·292 |
| Cacolet | 0 | 1 | 0 | — | | | — |
| Litter | 0 | 1 | 19 | — | | | — |
| Stretcher Mark III | 0 | 1 | 3 | — | | | — |
| „ Mark IV | 0 | 1 | 2 | — | | | ·08 |
| „ Mark V | 0 | 1 | 6 | — | | | ·08 |
| **Engineer carriages:** | | | | | | | |
| Pontoon wagon | 16 | 1 | 8 | 41 | 0 | 0 | 7·502 |
| Cable wagon | 21 | 1 | 5 | — | | | 6·777 |
| Office wagon | — | | | — | | | — |
| „ „ lithograph | 24 | 2 | 0 | — | | | 11·962 |
| „ „ photograph | 25 | 3 | 0 | — | | | 11·962 |
| „ „ printing | 24 | 1 | 0 | — | | | 11·962 |
| General service wagon | 21 | 0 | 14 | — | | | 4·408 |
| Air line wagon | 21 | 2 | 5 | — | | | 13·990 |
| Timber wagon | 20 | 1 | 0 | — | | | 4·813 |
| Truck for submarine mining | 6 | 3 | 14 | — | | | 1·555 |
| Entrenching barrow | 0 | 2 | 9 | — | | | 0·291 |
| **Field carriages, iron:** | | | | | | | |
| 9-pr. R.M.L. (6 cwt.) carriage, Mark I | 12 | 3 | 2 | 19 | 3 | 2 | 4·079 |
| „ „ limber „ | 11 | 1 | 23 | 16 | 0 | 13 | |
| „ „ carriage, Mark II | 11 | 3 | 16 | 34 | 3 | 6 | 3·818 |
| „ „ limber „ | 11 | 1 | 6 | | | | |
| „ wagon, Mark I | 14 | 2 | 14 | 41 | 1 | 25 | 4·493 |
| „ limber „ | 11 | 1 | 23 | | | | |
| „ wagon, Mark II | 16 | 1 | 4 | 41 | 0 | 6 | 4·373 |
| „ limber „ | 11 | 0 | 20 | | | | |
| 16-pr. R.M.L. carriage, Mark I | 13 | 1 | 19 | 43 | 0 | 19 | 4·079 |
| „ limber „ | 11 | 1 | 9 | | | | |
| „ carriage, Mark II | 13 | 0 | 0 | 42 | 3 | 3 | 4·112 |
| „ limber „ | 11 | 0 | 19 | | | | |
| „ wagon, Mark I | 14 | 3 | 5 | 43 | 2 | 7 | 4·493 |
| „ limber „ | 11 | 1 | 8 | | | | |
| „ wagon, Mark II | 16 | 0 | 16 | 43 | 0 | 0 | 4·438 |
| „ limber „ | 11 | 1 | 16 | | | | |
| 25-pr. R.M.L. carriage, Mark I | 15 | 1 | 0 | 51 | 3 | 7 | 4·177 |
| „ limber „ | 11 | 0 | 18 | | | | |
| „ wagon „ | 13 | 3 | 12 | 42 | 2 | 26 | 4·438 |
| „ limber „ | 11 | 0 | 18 | | | | |
| 7-pr. R.M.L. carriage colonial | 9 | 1 | 0 | 25 | 3 | 21 | 3·959 |
| „ limber | 9 | 2 | 0 | | | | |
| ·45″ Gatling gun carriage | 5 | 3 | 8 | — | | | 3·423 |
| „ limber | 8 | 0 | 6 | | | | |

Appendix A.—Weights and Tonnage of Travelling Carriages—*cont.*

| Nature. | Weight. Empty. | Weight. Packed. | Tonnage. |
|---|---|---|---|
| | cwts. qrs. lbs. | cwts. qrs. lbs. | tons. |
| **Field carriages, iron—*continued*** | | | |
| Forge wagon, Mark I | 11 3 0 | 38 2 4 | 4·819 |
| „ limber „ | 10 1 16 | | |
| „ wagon, Mark II | 14 2 4 | 42 0 0 | 5·820 |
| „ limber „ | 10 3 0 | | |
| Store wagon, Mark I | 14 1 24 | 40 3 10 | 5·820 |
| „ limber „ | 10 3 0 | | |
| **Field carriages, (steel):** | | | |
| 13-pr. R.M.L. carriage | 12 0 4 | 38 3 25 | 4·535 |
| „ limber | 12 0 12 | | |
| „ wagon | 17 2 22 | 48 0 6 | 4·523 |
| „ limber | 11 3 6 | | |
| 12-pr. B.L. carriage | 11 0 24 | 35 3 24 | — |
| „ limber | 10 3 7 | | — |
| „ wagon | 10 0 14 | 36 2 16 | — |
| 7-pr. 150 lbs. carriage, Gold Coast | 3 0 21 | — | — |
| **Field carriages, wood:** | | | |
| 6-pr. R.B.L. carriage, with limber | 11 3 0 | 15 3 0 | 2·70 |
| „ wagon „ | 15 0 0 | 19 0 0 | 2·60 |
| „ carriage „ (special) | 16 1 0 | 21 2 0 | 4·20 |
| „ wagon „ „ | 22 0 0 | 33 1 0 | 4·10 |
| 9-pr. R.B.L. carriage, with limber | 21 0 0 | 31 1 0 | 4·40 |
| „ wagon „ | 28 0 0 | 40 1 0 | 6·50 |
| 12-pr. R.B.L. carriage, with limber | 23 2 0 | 37 0 0 | 4·48 |
| „ wagon „ | 28 0 0 | 43 1 0 | 6·50 |
| 20-pr. R.B.L. carriage, with limber | 28 0 0 | 48 2 0 | 5·18 |
| „ wagon „ | 28 3 0 | 38 1 0 | 6·50 |
| 7-pr. 150 lbs carriage, Gold Coast | 2 2 0 | 3 3 0 | 0·515 |
| R.A. wagon, Mark I | 20 0 14 | — | 4·137 |
| „ Mark II | 20 3 0 | 47 1 24 | 4·659 |
| Artillery wagon | — | — | -- |
| **Mountain carriages:** | | | |
| 7-pr. R.M.L. (150 lbs.) carriage | 2 2 26 | 4 0 8 | 0·415 |
| 7-pr. R.M.L. (200 lbs.) carriage | 3 0 14 | 4 3 18 | 0·443 |
| „ „ limber | 3 1 18 | 4 2 22 | — |
| 2·5″ R.M.L. carriages, Mark I | 4 1 8 | — | 0·506 |
| „ „ Mark II | 4 3 7 | — | 0·506 |
| **S.A. amm. carriages:** | | | |
| S.A. amm. cart, Mark I | 8 2 0 | 20 0 2 | 2·468 |
| „ „ Mark II | 8 2 0 | — | 2·468 |
| „ wagon | 7 2 0 | — | 6·44 |
| „ limber | 6 2 0 | — | |
| **Siege carriages, iron and steel:** | | | |
| 25-pr. R.M.L. carriage (overbank) | 22 0 0 | 40 3 0 | *1·567 |
| 40-pr. R.M.L. 34 cwts., carriage, Mark I. | 27 0 5 | 61 3 14 | 4·058 |
| 40-pr, R.M.L. 34 or 35 cwts., carriage, Mark II. | 32 2 0 | 68 2 6 | 4·058 |
| 40-pr. R.M.L. 34 or 35 cwts. (overbank) | 42 0 0 | 78 0 6 | *1·039 |
| „ limber | 13 0 27 | 19 2 26 | 2·658 |
| 6·3″ R.M.L. howitzer carriage | 32 2 0 | 51 2 6 | 4·058 |
| 6·6″ „ „ „ | 32 2 0 | — | — |
| 8″ „ of 70 cwt. „ | 45 0 0 | — | 5·893 |
| 8″ „ of 46 cwt. „ | 45 0 4 | 91 2 9 | 5·284 |
| 6·6″ „ gun carriage, H. P. | 52 1 16 | — | 9·562 |
| „ „ „ limber | 11 3 13 | — | — |

* Top carriage only.

## Appendix A.—Weights and Tonnage of Travelling Carriages—*cont.*

| Nature. | Weight. Empty. | Weight. Packed. | Tonnage. |
|---|---|---|---|
| | cwts. qrs. lbs. | cwts. qrs. lbs. | tons. |
| Siege carriages, iron and steel—*continued.* | | | |
| 6·3″ and 6·6″ howitzer limber .. | 12 0 11 | — | 2·637 |
| 8″ of 70 cwt. howitzer limber .. | — | — | — |
| 7-pr. R.M.L. 200 lbs. bed .. .. | 2 0 0 | — | 0·335 |
| Sling wagon, iron, with limber.. .. | 44 2 4 | — | — |
| Siege carriages, wood: | | | |
| 5½″ mortar bed .. .. .. | 0 1 0 | — | 0·110 |
| 10″ mortar carriage and limber .. | 28 2 5 | — | 2·140 |
| 40-pr. R.B.L. carriage and limber .. | 42 1 0 | — | 6·180 |
| Platform wagon .. .. .. | 22 0 0 | — | 3·110 |
| Sling wagon, wood .. .. .. | 36 0 0 | — | 3·950 |
| Trench cart .. .. .. .. | 7 0 0 | 27 0 0 | 1·570 |
| Transport carriages: | | | |
| Wagon, G.S. (lock under), Mark II .. | 17 2 12 | 47 2 12 | 4·360 |
| „ „ „ Mark III .. | 17 1 10 | 47 1 10 | 4·304 |
| „ „ „ Mark IV .. | *18 3 12 | 48 3 12 | *4·169 |
| „ Transport .. .. .. | — | — | — |
| „ spring, heavy (iron) .. .. | 23 1 0 | 43 1 0 | 4·177 |
| „ „ light (wood) .. .. | 17 1 0 | 37 1 0 | 3·777 |
| „ bread and meat .. .. | 29 3 27 | — | 8·604 |
| „ bakery .. .. .. .. | 27 0 0 | — | 8·604 |
| Cart, spring (3rd class axle) .. .. | 11 0 0 | 26 0 0 | 2·239 |
| „ „ (2nd class axle) .. .. | 12 0 17 | 32 0 17 | 2·443 |
| „ tip, G.S. .. .. .. .. | 9 1 9 | 31 2 3 | 2·144 |
| „ Maltese, Mark II .. .. | 5 2 9 | — | 1·750 |
| „ „ Mark III .. .. | 6 0 13 | — | 1·600 |
| „ „ Mark III (special) .. | 6 2 2 | — | 1·600 |
| „ „ Mark IV .. .. | 6 2 0 | — | 2·307 |
| „ water Mark I .. .. .. | 7 0 7 | — | 5·325 |
| „ „ Mark II .. .. | 7 1 25 | — | 5·325 |
| „ „ Mark III .. .. | 7 1 12 | — | 4·746 |
| „ „ Mark IV .. .. | 7 0 14 | — | 4·026 |
| „ Forage .. .. .. .. | 8 0 14 | — | 2·712 |
| „ Forge .. .. .. .. | 13 0 15 | — | 3·187 |

* With pole and additional fittings.

# APPENDIX B.

## TABLE OF GARRISON MOUNTINGS FOR RIFLED GUNS.

| Ordnance. | Carriages. | Platforms. | Weight. | Length. | Height of parapet or sill. | Medium No. | List of Changes. | Page in Treatise. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | cwts. qrs. lbs. | ft. in. | ft. in. | No. | § | | |
| B.L., 12″, 43 tons. | 1. Sliding .. .. .. .. | .. .. .. .. .. | 162 3 0 | — | — | — | 4866 | 272 | |
| | | Upper tier.. .. .. .. | 185 3 0 | 15 6 | 3 0 | — | | 285 | |
| | | Lower „ .. .. .. | 191 0 0 | | | | | 276 | |
| B.L., 6″, Mark V | Hydro-pneumatic 1. .. .. | .. .. .. .. .. | 295 3 8 | — | 8 11·4 | — | — | 287 | |
| „ IV | 2. .. .. | .. .. .. .. .. | *352 1 23 | — | 9 1·7 | — | — | 504 | |
| R.B.L. 7″, 82 cwt. | 1. Wood sliding casemate .. | .. .. .. .. .. | 15 0 0 | — | — | 15 | 416 | 154 | |
| | | Wood casemate .. .. .. | 27 0 0 | 16 0 | 2 7 | 14 | 613 | 207 | |
| | 2. Wood sliding dwarf .. .. | .. .. .. .. .. | 15 2 0 | — | — | 16 | 346 | 154 | |
| | | Wood dwarf .. .. .. | 37 0 0 | 16 0 | 4 3 | 16 | 3576 | 209 | |
| | 3. Wrought-iron S.P. sliding, with E.O.C. compressor | .. .. .. .. .. | — | — | — | 3 | 4209 | 196 | |
| | | Wood, 11′.. .. .. .. | 30 3 0 | 11 0 | 3 6 | 13 | 4209 | 210 | |
| | 4. Wrought-iron S.P. sliding, with hydraulic buffer | .. .. .. .. .. | 23 3 0 | — | — | 2 | 4210 | 195 | |
| | | Wood, 13′ 2″, 4′ 3″ parapet .. | 44 0 0 | 13 2 | 4 3 | 11 | 4212 | 210 | |
| | | „ „ 3′ 6″ „ .. | 34 3 0 | 13 2 | 3 6 | 12 | 4212 | 210 | |

* Includes weight of bedding plates and bolts = 28 cwt. 1 qr. 21 lbs.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5. Wrought-iron D.P. sliding .. | .. .. .. .. .. | 31 1 0 | — | — | 1 | 4003 | 194 | | | |
| | | Wrought-iron, 4′ 3″ parapet .. | 50 0 0 | 12 0 | 4 3 | 1 | 4614 | 251 | | | |
| | | „ 3′ 6″ „ .. | — | 12 0 | 3 6 | 2 | 4003 | 252 | | | |
| | | „ 2′ 7″ „ .. | — | 12 0 | 2 7 | 3 | 4614 | 252 | | | |
| | 6. Moncrieff, Mark II .. .. | .. .. .. .. .. | 179 2 0 | — | — | — | — | 267 | | | |
| | | Moncrieff, Mark II. .. .. | 83 1 0 | 15 3 | 11 0 | — | — | 267 | | | |
| R.B.L., 7″ 72 cwt. | 1. Wood sliding, converted from naval | .. .. .. .. .. | 14 2 0 | — | — | 18 | 1202 | 353 | | | |
| | | Wood converted from naval slide | 18 3 0 | 14 0 | 3 6 | 15 | 1202 | 211 | | | |
| | 2. Wood sliding dwarf .. .. | .. .. .. .. .. | 15 0 0 | — | — | 17 | 677 | 154 | | | |
| | | Wood, dwarf .. .. .. | 37 0 0 | 16 0 | 4 3 | 16 | 3576 | 209 | | | |
| R.B.L., 40-pr. | 1. Wood standing .. .. | .. .. .. .. .. | 13 3 0 | — | — | — | — | 153 | | | |
| | 2. „ converted non-recoil | .. .. .. .. .. | 23 1 0 | — | — | — | 1092 / 1248 | 154 | | | |
| | 3. Wrought iron standing .. | .. .. .. .. .. | 17 1 0 | — | — | — | 1474 | | | | |
| | 4. Wood sliding casemate .. | .. .. .. .. .. | 10 2 0 | — | — | 19 | 613 | 154 | | | |
| | | Wood, casemate .. .. .. | 27 0 0 | 16 0 | 2 7 | 14 | 613 | | | | |
| | 5. Wood sliding dwarf .. .. | .. .. .. .. .. | 11 2 0 | — | — | 20 | — | 154 | | | |
| | | Wood, dwarf .. .. .. | 33 3 0 | 16 0 | 4 3 | 17 | — | | | | |
| | 6. Wrought-iron sliding .. | .. .. .. .. .. | 21 0 0 | — | — | 4 | 4235 | 197 | | | |
| | | Wrought-iron .. .. .. | 22 0 0 | 8 7 | 2 3 | 4 | 4235 | 160 | | | |
| | 7. Lattice girder, 6′ parapet for side closing gun | .. .. .. .. .. | 26 3 0 | — | 6 0 | — | 4407 | 92 | | | |
| R.B.L., 20-pr. | 1. Wrought-iron sliding .. | .. .. .. .. .. | — | — | — | 5 | 4211 | 199 | | | |
| | | Wrought iron .. .. .. | — | 7 2 | 2 3 | 5 | 4211 | 252 | | | |
| R.M.L., 12·5″, 38 tons. | 1. 6′ recoil, Mark II .. .. | .. .. .. .. .. | 123 2 0 | — | — | — | 4098 | 178 | | | |
| | | 6′ recoil casemate, Mark II .. | 162 1 0 | 15 6 | 3 2 | — | 4112 | 240 | | | |
| | | „ „ „ III .. | 162 1 0 | 15 6 | 3 2 | — | 4112 | 240 | | | |
| | | „ „ „ III, special | 162 3 0 | 15 6 | 3 2 | — | 4197 | 249 | | | |
| | | „ dwarf C „ II .. | 188 1 0 | 15 6 | 4 3 | — | 3098 | 249 | | | |
| | | „ „ C „ III .. | 188 1 0 | 15 6 | 4 3 | — | 3098 | 249 | | | |
| | | „ „ D „ II .. | 184 1 0 | 15 6 | 4 3 | — | 3099 | 249 | | | |
| | | „ „ D „ III .. | 184 1 0 | 15 6 | 4 3 | — | 3099 | 249 | | | |

## Table of Garrison Mountings for Rifled Guns—*continued.*

| Ordnance. | Carriages. | Platforms. | Weight. | Length. | Height of parapet or sill. | Medium No. | List of Changes. | Page in Treatise. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | cwts. qrs. lbs. | ft. in. | ft. in. | No. | § | | |
| R.M.L., 12·5″, 38 tons—*cont.* | 2. 7′ recoil, Mark II .. .. | .. .. .. .. .. | 123 2 0 | — | — | — | 4167 | 186 | |
| | | 7′ recoil, casemate, Mark II .. | 163 2 0 | 16 6 | 3 2 | — | 4167 | 249 | |
| | | ,, ,, ,, III .. | 163 2 0 | 16 6 | 3 2 | — | 4167 | 249 | |
| | 3. 6′ recoil, small port, Mark I.. | .. .. .. .. .. | 193 3 0 | — | — | — | 3836 | 186 | |
| | | 6′ recoil, small port, Mark II .. | 169 1 0 | 15 6 | — | — | 4026 | 250 | |
| | | ,, ,, ,, III .. | 169 1 0 | 15 6 | — | — | 4112 | 250 | |
| | 4. 7′ recoil, small port, Mark I.. | .. .. .. .. .. | 206 3 0 | — | — | — | 4253 | 193 | |
| | | 7′ recoil, small port, Mark I .. | 150 0 0 | 16 6 | — | — | 4253 | 250 | |
| R.M.L., 12″, 35 tons. | 1. Wrought-iron sliding.. .. | .. .. .. .. .. | 115 1 0 | — | — | — | 3085 | 178 | |
| | | Dwarf C .. .. .. | 186 3 0 | 15 6 | 4 3 | — | 3102 | 239 | |
| R.M.L., 11″ and 12″, 25 tons. | 1. Single plate .. .. .. | .. .. .. .. .. | 60 3 0 | — | — | — | 1584 | 162 | |
| | | Single plate .. .. .. | 102 0 0 | 15 0 | 3 0 | — | 1584 | 211 | |
| | 2. Double plate .. .. .. | .. .. .. .. .. | 67 3 0 | — | — | — | 1635 | 177 | |
| | | Casemate .. .. .. .. | 115 0 0 | 15 0 | 3 0 | — | 1635 | 236 | |
| | | Dwarf A .. .. .. .. | 139 1 0 | 15 0 | 4 3 | — | 1635 | 237 | |
| | | ,, C .. .. .. .. | 142 1 0 | 15 0 | 4 3 | — | 1635 | 238 | |
| R.M.L., 10″, 18 tons. | 1. Sliding, Mark I .. .. | .. .. .. .. .. | 51 1 0 | — | — | — | 1937 | 173 | |
| | | Casemate, Mark I .. .. | 95 2 0 | 15 0 | 2 6 | — | 1937 | 229 | |
| | | Dwarf A .. .. .. .. | 134 1 0 | 15 0 | 4 3 | — | 1937 | 233 | |
| | | ,, C .. .. .. .. | 140 2 0 | 15 0 | 4 3 | — | 1937 | 234 | |
| | | ,, D .. .. .. .. | 141 0 0 | 15 0 | 4 3 | — | 1937 | 235 | |
| | | ,, rear traversing .. .. | 158 0 0 | 15 0 | 7 0 | — | — | 235 | |
| | 2. Sliding, Mark II .. .. | .. .. .. .. .. | 67 0 0 | — | — | — | 2513 | 174 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Casemate, Mark II .. .. | 104 0 0 | 15 0 | 2 6 | — | 2513 | 232 | |
| | | „ „ special .. | 125 0 0 | 15 0 | 3 3 | — | 3011 | 233 | |
| | 3. Small port .. .. .. | .. .. .. .. .. | 120 0 0 | — | — | — | 3182 | 175 | |
| | | Small port.. .. .. .. | 106 0 0 | 15 0 | — | — | 3182 | 236 | |
| R.M.L., 9″ 12 tons. | 1. Single plate casemate.. .. | .. .. .. .. .. | 37 0 0 | — | — | — | 1584 | 162 | |
| | | Single plate, casemate .. .. | 57 3 0 | 15 0 | 2 6 | — | 1584 | 211 | |
| | 2. Single plate dwarf .. .. | .. .. .. .. .. | 39 0 0 | — | — | — | 1584 | 162 | |
| | | Single plate, dwarf A .. .. | 74 0 0 | 15 0 | 4 3 | — | 1584 | 211 | |
| | | „ „ „ D .. .. | 74 0 0 | 15 0 | 4 3 | — | 1584 | 211 | |
| | 3. Double plate .. .. .. | .. .. .. .. .. | 42 1 0 | — | — | — | 1635 | 171 | |
| | | Casemate .. .. .. .. | 74 3 0 | 15 0 | 2 6 | — | 1635 | 220 | |
| | | Dwarf A .. .. .. .. | 97 0 0 | 15 0 | 4 3 | — | 1635 | 224 | |
| | | „ C .. .. .. .. | 101 2 0 | 15 0 | 4 3 | — | 1635 | 225 | |
| | | „ D .. .. .. .. | 107 0 0 | 15 0 | 4 3 | — | 1635 | 228 | |
| | | „ rear traversing .. .. | 120 0 0 | 15 0 | 7 0 | — | — | 227 | |
| | 4. Moncrieff, Mark II .. .. | .. .. .. .. .. | 533 0 0 | — | — | — | 3115 | 267 | |
| | | Moncrieff, Mark II .. .. | 272 2 0 | 19 9 | 12 6 | — | 3115 | 267 | |
| | 5. Sliding, converted naval .. | .. .. .. .. .. | 44 0 0 | — | — | — | — | 163 | |
| | | Converted naval slide .. .. | 60 0 0 | — | — | — | — | 212 | |
| R.M.L., 8″ | 1. Sliding converted naval for coaling stations | .. .. .. .. .. | 39 1 0 | — | — | — | — | 163 | |
| | | Converted naval slide for coaling stations | 55 1 0 | — | — | — | — | 212 | |
| R.M.L., 7′, 7 tons. | 1. Single plate casemate.. .. | .. .. .. .. .. | 27 3 0 | — | — | — | 1584 | 162 | |
| | | Casemate .. .. .. .. | 55 2 0 | 15 0 | 2 6 | — | 1584 | 211 | |
| | 2. Single plate dwarf .. .. | .. .. .. .. .. | 29 0 0 | — | — | — | 1584 | 162 | |
| | | Dwarf A .. .. .. .. | 69 2 0 | 15 0 | 4 3 | — | 1584 | 211 | |
| | | „ D .. .. .. .. | 69 2 0 | 15 0 | 4 3 | — | 1584 | 211 | |
| | 3. Double plate .. .. .. | .. .. .. .. .. | 27 3 0 | — | — | — | 1635 | 165 | |
| | | Casemate .. .. .. .. | 53 0 0 | 15 0 | 2 6 | — | 1635 | 215 | |
| | | Dwarf A .. .. .. .. | 77 3 0 | 15 0 | 4 3 | — | 1635 | 219 | |
| | | „ C .. .. .. .. | 80 3 0 | 15 0 | 4 3 | — | 1635 | 220 | |
| | | „ D .. .. .. .. | 80 3 0 | 15 0 | 4 3 | — | 1635 | 220 | |

## Table of Garrison Mountings for Rifled Guns—*continued.*

| Ordnance. | Carriages. | Platforms. | Weight. | Length. | Height of parapet or sill. | Medium No. | List of Changes. | Page in Treatise. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | | cwts. qrs. lbs. | ft. in. | ft. in. | No. | § | | |
| R.M.L., 7", 7 tons—*cont.* | 4. Moncrieff, Mark I | | 332 0 0 | — | — | — | 2434 | 259 | |
| | | Moncrieff, Mark I | 113 0 0 | 16 0 | 9 10½ | — | 2434 | 262 | |
| | 5. Moncrieff, Mark II | | 370 2 0 | — | — | — | 2915 | 264 | |
| | | Moncrieff, Mark II | 198 2 0 | 17 0 | 11 0 | — | 2915 | 264 | |
| R.M.L., 7", 6½ tons. | 1. Double plate | | 54 1 0 | — | — | 7 | 3986 | 200 | |
| | | 6′ parapet | 75 1 0 | 13 0 | 6 0 | 7 | 3986 | 253 | |
| | 2. Single plate | | 27 2 0 | — | — | — | 3835 | 163 | |
| | | 4′ 3″ parapet | 80 3 0 | 12 0 | 4 3 | — | 3835 | 220 | |
| R.M.L., 80-pr. | 1. Wood sliding casemate | | 15 1 0 | — | — | 21 | — | 154 | |
| | | Wood casemate | 27 0 0 | 16 0 | 2 7 | 14 | 613 | 207 | |
| | 2. Wood sliding dwarf | | 15 3 0 | — | — | 22 | 4632 | 154 | |
| | | Wood dwarf, 4′ 3″ parapet | 37 0 0 | 16 0 | 4 3 | 16 | 3576 | 209 | |
| | | „ „ 6′ „ | 53 0 0 | 16 0 | 6 0 | 18 | 4485 | 209 | |
| R.M.L., 64-pr., 71 cwt. | 1. Wood standing | | 8 3 0 | — | — | — | 3092 | 152 | |
| | 2. W.I. standing | | 17 1 0 | — | — | — | 1474 | 159 | |
| | 3. Wood sliding, dwarf | | 14 3 0 | — | — | 23 | 4485 | 154 | |
| | | Wood dwarf, 4′ 3″ parapet | 37 0 0 | 16 0 | 4 3 | 16 | 3576 | 209 | |
| | | „ „ 6′ „ | 53 0 0 | 16 0 | 6 0 | 18 | 4485 | 209 | |
| | 4. Wrought-iron sliding for buffer | | 23 0 0 | — | — | 10 | 4615 | 204 | |
| | | Wood, 13′ 2″, 3′ 6″ parapet | 34 3 0 | 13 2 | 3 6 | 12 | 4212 | 210 | |
| | | „ „ 4′ 3″ „ | 44 0 0 | 13 2 | 4 3 | 11 | 4212 | 210 | |
| | 5. Wrought-iron sliding, with E.O.C. compressor | | 24 2 0 | — | — | 11 | 4616 | 205 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 6. Wrought-iron sliding for buffer | Wood, 11′.. .. .. .. | 30 3 0 | 11 0 | 3 6 | 13 | 4209 | 210 | |
| | | .. .. .. .. .. | 23 0 0 | — | — | 12 | 4617 | 205 | |
| | | Wood, 13′ 2″, 2′ 7″ parapet .. | — | 13 2 | 2 7 | 19 | 4617 | 211 | |
| R.M.L., 64-pr., 64-cwt. | 1. Wrought-iron standing .. | .. .. .. .. .. | 17 1 0 | — | — | — | 1474 | 159 | |
| | 2. Wrought-iron sliding.. .. | .. .. .. .. .. | 27 0 0 | — | — | 9 | 3834 | | |
| | | For 5′ 6″ parapet .. .. | 58 0 0 | 13 0 | 5 6 | 9 | 3834 | 258 | |
| | 3. Wrought-iron sliding.. .. | .. .. .. .. .. | 34 3 0 | — | — | 8 | 3861 | 203 | |
| | | With circular buffer, 6′ parapet | 65 3 0 | 13 0 | 6 0 | 8 | 3861 | 256 | |
| R.M.L., 64-pr., 58 cwt. | 1. Wood standing .. .. | .. .. .. .. .. | 14 3 0 | — | — | — | 3113 | 152 | |
| | 2. W.I. standing.. .. .. | .. .. .. .. .. | 17 1 0 | — | — | — | 1474 | 159 | |
| | 3. Depression .. .. .. | .. .. .. .. .. | 16 0 0 | — | — | — | 2706 | 153 | |
| | 4. Wood sliding casemate .. | .. .. .. .. .. | 11 0 0 | — | — | 25 | 613 | 154 | |
| | | Wood casemate .. .. .. | 27 0 0 | 16 0 | 2 7 | 14 | 4722 | 207 | |
| | 5. Wood sliding dwarf .. .. | .. .. .. .. .. | 14 0 0 | — | — | 24 | 3576 | 154 | |
| | | Dwarf, 4′ 3″ parapet .. .. | 37 0 0 | 16 0 | 4 3 | 16 | 3576 | 209 | |
| | | ,, 6′ ,, .. .. | 53 0 0 | 16 0 | 6 0 | 18 | 4485 | 209 | |
| | 6. Wrought-iron sliding.. .. | .. .. .. .. .. | 22 1 0 | — | — | 13 | 4212 | 210 | |
| | | Wood, 13′ 2″, 4′ 3″ parapet .. | 44 0 0 | 13 2 | 4 3 | 11 | 4212 | 210 | |
| | | ,, ,, 3′ 6″ ,, .. | 34 3 0 | 13 2 | 3 6 | 12 | 4212 | 210 | |
| | 7. Moncrieff .. .. .. | .. .. .. .. .. | 154 2 0 | — | — | — | 3633 | 267 | |
| | | Moncrieff .. .. .. .. | 74 2 0 | 15 0 | 9 4 | — | 3633 | 267 | |
| 8″ R.M.L. 46 cwt. howitzer. | Bed .. .. .. .. | .. .. .. .. .. | 33 0 0 | — | — | — | 3130 | 158 | |
| 6·3″ or 6·6″ howitzer, R.M.L. | Bed .. .. .. .. | .. .. .. .. .. | 31 1 0 | — | — | — | 3506 | 155 | |

# APPENDIX C.

## TABLE OF WEIGHTS AND TONNAGE OF MISCELLANEOUS CARRIAGES, &c., FOR GARRISON SERVICE.

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | tons. |
| **Barrows:** | | | | |
| Magazine barrow, single | 0 | 2 | 13 | ·172 |
| „ double | 1 | 1 | 20 | — |
| Powder barrow, two wheels | 1 | 0 | 3 | ·182 |
| Projectile barrow, iron 10″ | 1 | 1 | 20 | ·215 |
| „ „ 11″ or 12″ 25 tons | 1 | 1 | 25 | ·256 |
| „ „ 12″ 35 tons | 2 | 0 | 0 | ·289 |
| „ „ 12·5″ | 2 | 0 | 10 | ·247 |
| „ wood, 7″ to 12″ | 0 | 2 | 6 | ·125 |
| „ 12″ and 12·5″ | 1 | 0 | 0 | ·249 |
| „ road | 2 | 2 | 0 | ·527 |
| „ shingle | 4 | 1 | 0 | 1·435 |
| **Beds, mortar:** | | | | |
| 4⅘-in. mortar-bed | 0 | 3 | 0 | ·04 |
| 5½-in. „ | 1 | 0 | 0 | ·11 |
| 8-in. „ | 8 | 3 | 0 | ·29 |
| 10-in. „ | 17 | 3 | 0 | ·56 |
| 13-in. „ | 32 | 3 | 0 | 1·22 |
| **Carts:** | | | | |
| Hand cart | 4 | 3 | 0 | 1·25 |
| Sling cart | 18 | 0 | 0 | 3·95 |
| Trench cart | 7 | 0 | 0 | 1·57 |
| **Drugs:** | | | | |
| Small or West India drug | 5 | 0 | 0 | ·58 |
| Medium „ | 10 | 2 | 0 | 2·02 |
| Large „ | 17 | 2 | 0 | 2·17 |
| Gun drug to 5 tons | 16 | 1 | 0 | 1·81 |
| „ to 25 tons | 61 | 1 | 0 | 7·25 |
| **Carriage, transporting heavy guns on inclines:** | | | | |
| Front cradle | 51 | 2 | 0 | — |
| Rear „ | 48 | 2 | 20 | — |
| Bars and lever | 5 | 3 | 22 | — |
| **Sleighs:** | | | | |
| Sleigh, 18 to 25 tons | 59 | 1 | 14 | 4·35 |
| „ 18 to 38 tons | 51 | 3 | 0 | 3·406 |
| „ „ rollers for | 11 | 3 | 0 | ·525 |
| **Wagons:** | | | | |
| Wagon, platform | | — | | — |
| „ sling iron, Mark I | 44 | 2 | 4 | 5.556 |
| „ „ wood, Mark II | 36 | 1 | 0 | 8·27 |

# APPENDIX D.

## Table of Weights and Tonnage of Naval Carriages.

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | tons. |
| Barrows: | | | | |
| Barrow for projectiles under 10″ .. .. .. | | — | | — |
| „ iron, for projectiles, 10″ .. .. .. | 1 | 1 | 20 | 0·215 |
| „ „ „ 11″ or 12″ 25 tons .. | 1 | 1 | 25 | 0·256 |
| „ „ „ 12″ 35 tons .. .. | 2 | 0 | 0 | 0·289 |
| „ „ „ 12·5″ .. .. .. | 2 | 0 | 10 | 0·247 |
| 7-pr. R.M.L. (steel) carriage, Mark I.. .. .. | 1 | 0 | 21 | 0·007 |
| 9-pr. R.M.L. (6 cwt.) „ wood .. .. .. | 2 | 3 | 20 | — |
| „ (8 cwt.) „ „ .. .. .. | 2 | 3 | 20 | — |
| „ (6 or 8 cwt.) carriage, iron .. .. | 2 | 2 | 16 | 0·307 |
| Carriages, ship, wood: | | | | |
| 20-pr. R.B.L. gunboat, sliding carriage, Mark II .. | 3 | 0 | 0 | 0·3 |
| „ „ „ Mark III .. | | — | | 0·357 |
| 40-pr. R.B.L. standing carriage .. .. .. | 8 | 1 | 0 | 2·013 |
| „ „ „ upper deck .. .. | 6 | 2 | 0 | 1·5 |
| „ sliding „ .. .. .. | 14 | 1 | 0 | 2·375 |
| „ 64 cwt., standing „ upper deck .. | 8 | 0 | 0 | 1·875 |
| „ „ „ „ main deck .. | 8 | 2 | 0 | 2·0 |
| „ „ sliding „ .. .. | 14 | 0 | 0 | 1·925 |
| „ 71 cwt., standing „ .. .. | 9 | 1 | 0 | 2·028 |
| „ „ sliding „ .. .. | 14 | 1 | 0 | 1·9 |
| 7″ R.B.L. sliding carriage .. .. .. .. | 15 | 3 | 0 | 2·013 |
| Carriages, ship, iron and steel for R.B.L. and R.M.L. guns: | | | | |
| 20-pr. R.B.L., upper deck .. .. .. .. | 5 | 1 | 0 | 0·289 |
| „ gun vessel .. .. .. .. | 4 | 0 | 0 | 0·243 |
| 64-pr. R.M.L., 64 cwt., Mark I .. .. .. | 14 | 2 | 0 | 0·887 |
| „ „ Mark II .. .. .. | 14 | 3 | 0 | 0·96 |
| „ „ Mark III .. .. .. | 11 | 3 | 0 | 1·039 |
| „ „ Mark IV .. .. .. | 23 | 1 | 0 | 1·298 |
| „ „ Mark V .. .. .. | 23 | 3 | 0 | 1·139 |
| „ „ Mark VI .. .. .. | 26 | 0 | 0 | 1·234 |
| 7″ R.M.L., 90 cwt. .. .. .. .. .. | 25 | 1 | 0 | 1·575 |
| „ 6½ tons .. .. .. .. .. | 31 | 1 | 0 | 1·763 |
| 8″ R.M.L. .. .. .. .. .. .. | 42 | 3 | 0 | 2·412 |
| 9″ R.M.L. service .. .. .. .. .. | 46 | 3 | 0 | 2·668 |
| „ "Sultan" type .. .. .. .. | 40 | 1 | 0 | 2·05 |
| „ for "Shannon" .. .. .. .. | 43 | 0 | 0 | 2·811 |
| „ turret, "Scorpion" .. .. .. | | — | | — |
| „ „ "Wivern" .. .. .. .. | 63 | 0 | 0 | 4·434 |
| 10″ R.M.L. "Sultan" type .. .. .. .. | 82 | 1 | 0 | 5·585 |
| 10″ R.M.L. gunboat .. .. .. .. .. | 80 | 0 | 0 | 3·827 |
| „ turret, for "Hecate" .. .. .. | 188 | 2 | 0 | 9·118 |
| „ „ for "Rupert" .. .. .. | 189 | 1 | 0 | 9·118 |
| 11″ R.M.L. .. .. .. .. .. .. | 89 | 2 | 0 | 3·844 |
| 12″ R.M.L., 25 tons, for "Belleisle" and "Orion" .. | 83 | 0 | 0 | 7·607 |
| „ „ turret, for "Glatton" .. .. | 206 | 1 | 0 | 10·937 |
| „ „ for "Monarch" .. .. .. | 209 | 0 | 0 | 8·233 |
| 12″ R.M.L., 35 tons, turret, for "Devastation" .. | 223 | 3 | 0 | 11·908 |
| Carriages for B.L. guns: | | | | |
| 6″ Armstrong .. .. .. .. .. .. | 23 | 1 | 0 | 0·955 |

Appendix D.—Weights and Tonnage of Naval Carriages—*contd.*

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | tons. |
| Vavasseur carriages: | | — | | — |
| 4″ broadside, Mark I | | | | |
| „ „ Mark II | 7 | 0 | 0 | 0·443 |
| „ C.P. | 8 | 0 | 14 | — |
| 5″ broadside, Mark I | 11 | 2 | 0 | 0·791 |
| „ „ „ II | 11 | 2 | 0 | — |
| „ C. P. | 12 | 0 | 0 | — |
| 6″ broadside, metal | 25 | 1 | 0 | 1·141 |
| steel | 23 | 1 | 0 | — |
| „ C. P. | 22 | 1 | 0 | — |
| 8″ broadside | 45 | 2 | 0 | — |
| „ C. P. | 38 | 0 | 0 | — |
| Slides, boat: | | | | |
| 7-pr. R.M.L. (200 lbs. steel) iron slide | 2 | 1 | 17 | 0·257 |
| 9-pr. R.M.L. (6 cwt.) wood slide | 4 | 1 | 7 | — |
| „ (8 cwt.) „ | 4 | 2 | 25 | — |
| „ (6 or 8 cwt.) iron slide | 4 | 3 | 0 | 0·320 |
| Slides, ship, wood:— | | | | |
| 20-pr. R.B.L., bow, Mark II | 3 | 2 | 0 | 0·082 |
| „ „ Mark III | 4 | 3 | 0 | 0·285 |
| „ stern, Mark II | 5 | 3 | 0 | 0·230 |
| „ „ Mark III | 6 | 0 | 0 | 1·412 |
| „ upper deck | 6 | 3 | 0 | 0·849 |
| 40-pr. R.B.L., 10′ long | 13 | 3 | 0 | 1·875 |
| „ 10½′ „ | 14 | 1 | 0 | 1·950 |
| „ 11′ „ | 14 | 2 | 0 | 2·050 |
| 64-pr. R.M.L. 58 cwt., 14½′ long | 17 | 1 | 0 | 2·875 |
| „ 64 cwt., 10½′ „ | 16 | 0 | 0 | 1·950 |
| „ „ 11½′ „ | 18 | 0 | 0 | 2·175 |
| „ „ 12′ „ | 19 | 0 | 0 | 2·350 |
| „ „ 14′ „ | 19 | 3 | 0 | 2·625 |
| „ 71 cwt., 10½′ „ | 16 | 0 | 0 | 1·950 |
| „ „ 14′ „ | 19 | 3 | 0 | 2·625 |
| 7″ R.B.L. 68-pr. S.B. or 10″ S.B., 12½′ long | 25 | 0 | 0 | 2·850 |
| „ „ „ 14′ „ | 26 | 2 | 0 | 3·200 |
| Slides, ship, iron for R.B.L. and R.M.L. guns: | | | | |
| 20-pr. R.B.L. upper deck | 9 | 3 | 0 | 0·733 |
| „ gun vessel | 8 | 3 | 0 | 0·369 |
| 64-pr. R.M.L. 64 cwts., Mark I | 23 | 2 | 0 | 2·502 |
| „ Mark II | 24 | 1 | 0 | 2·174 |
| „ Mark III | 22 | 3 | 0 | 2·366 |
| „ Mark IV | 29 | 3 | 0 | 2·761 |
| „ Mark V broadside | 28 | 1 | 0 | 3·009 |
| „ Mark V traversing | 29 | 3 | 0 | 2·765 |
| „ Mark VI | 30 | 2 | 0 | 2·765 |
| 7″ R.M.L. 90 cwts., with buffers, side | 41 | 0 | 0 | 2·624 |
| „ „ traversing | 43 | 1 | 0 | 2·624 |
| 7″ R.M.L. 6½ tons | 44 | 3 | 0 | 2·481 |
| 8″ R.M.L. side | 60 | 3 | 0 | 4·883 |
| „ traversing | 67 | 2 | 0 | 4·883 |
| 9″ R.M.L. service pattern, side | 71 | 0 | 0 | 5·937 |
| „ „ traversing | 75 | 2 | 0 | 6·093 |
| „ "Sultan" type, side | 62 | 1 | 0 | 7·139 |
| „ „ traversing | 64 | 3 | 0 | 7·139 |
| „ for "Shannon" | *77 | 1 | 0 | 6·577 |
| 10″ R.M.L. "Sultan" type, side | 132 | 2 | 0 | 10·839 |
| „ „ traversing | 145 | 1 | 0 | 11·241 |
| „ "Temeraire" type | †133 | 2 | 0 | 9·769 |
| „ Gunboat | 77 | 2 | 0 | 5·980 |

* Bow slides, 81 cwts. and 6·412 tons.

† With brake on racer, 144½ cwt. and 10·308 tons.

Appendix D.—Weights and Tonnage of Naval Carriages—*contd.*

| Nature. | Weight. | | | Tonnage. |
|---|---|---|---|---|
| | cwts. | qrs. | lbs. | tons. |
| Slides, ship, iron for R.B.L. and R.M.L. guns—*contd.* | | | | |
| 11″ R.M.L. .. .. .. .. .. .. | 166 | 0 | 0 | 7·468 |
| 12″ R.M.L. 25 tons, for "Belleisle" and "Orion," with buffers. | 157 | 0 | 0 | 14·072 |
| Travelling carriages: | | | | |
| 9-pr. R.M.L. 6 cwt. carriage .. .. .. .. | 6 | 1 | 21 | 2·650 |
| „ „ limber .. .. .. .. | 5 | 3 | 11 | |
| „ 8 cwt. carriage .. .. .. .. | 6 | 2 | 6 | 2·559 |
| „ „ limber .. .. .. .. | 5 | 1 | 13 | |
| „ 6 or 8 cwt. carriage (steel) .. .. | 6 | 2 | 7 | 1·324 |
| ·45″ Gatling gun, carriage .. .. .. .. | 4 | 0 | 3 | 1·572 |
| „ limber .. .. .. .. | 4 | 2 | 24 | |
| ·45″ Gardner gun carriage .. .. .. .. | | — | | — |
| „ limber .. .. .. .. | | — | | — |

# APPENDIX E.

## Details of Gun Carriages and Ammunition Wagons.

| Details. | Gun Carriages, Land Service. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mountain. | | 7-pr. Colonial. | 9-pr. R.M.L. 6 cwt. | | 13-pr. | 16-pr. R.M.L. | | 12-pr. B.L. | ·45" Gatling. |
| | 7-pr. 200 lb. Gun. | 2·5 inch. | | Mark I | Mark II | R.M.L. | Mark I | Mark II | | |
| | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. |
| Maximum length with gun | — | — | — | 22 4½ | 22 6 | 22 8½ | 22 10 | 23 0 | 23 4½ | — |
| Maximum length without gun | 14 4½ | 4 1 | — | 21 0½ | 21 3½ | 19 7 | 21 0½ | 21 2 | 20 4½ | — |
| Maximum width | 2 10½ | 1 1 | 6 1 | 6 4½ | 6 4½ | 6 3½ | 6 3½ | 6 3½ | — | 6 3½ |
| Track of wheels | 2 3 | 3 0 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 |
| Diameter of wheels | 3 0 | 3 0 | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 4 8 |
| Length between axles | 5 6½ | — | 6 11½ | 8 9¾ | 9 1 | — | 8 9¾ | 9 0 | — | 6 6 |
| Height to axis of trunnions | 2 1¾ | 2 2 | 3 8¾ | 3 6 | 3 6½ | 3 7 | 3 7½ | 3 7¼ | 3 3½ | 3 3½ |
| Space required to turn in | — | — | 27 7 | 27 7 | 32 3 | 26 8 | 32 4 | 32 9 | — | 24 6 |
| Angle of trail with ground | 24° | 33° | 28° | 22° | 23° | 30° | 22° | 24° | 27° | 27° |
| Angle of lock | — | — | 44° | 52° | 56½° | — | 51° | 54½° | — | 45° |
| Maximum elevation for gun | 33¾° | 25° | 35° | 21½° | 22° | 16° | 22½° | 17½° | 16° | 20½° |
| Maximum depression for gun | 7¼° | 10° | 10° | 4° | 6½° | 5° | 12½° | 15° | 8° | 19¼° |
| Upsetting angle, packed | — | — | 36° | 40¾° | 39° | — | 38¾° | 38° | — | — |
| | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts qrs. lbs. |
| Pressure of trail on ground, packed | 0 2 18 | — | 1 2 11 | 2 0 0 | 1 2 25 | — | 2 1 14 | 1 3 12 | 1 2 14 | — |
| Pressure of shafts on horse, packed | — | — | 0 1 22 | 0 2 1 | 0 2 13 | — | 0 2 10 | 0 2 2 | 0 2 4 | — |
| Pressure of fore wheels on ground | — | — | 14 3 9 | 16 3 15 | 16 2 25 | — | 16 3 19 | 16 3 20 | 11 3 17 | — |
| Pressure of hind wheels on ground | — | — | 10 2 18 | 18 1 16 | 16 2 16 | — | 25 0 21 | 24 3 13 | 9 3 4 | — |
| Number of rounds carried | 16 | — | 66 | 40 | 40 | — | 28 | 28 | — | 2600 |

## Appendix E.—Details of Gun and Ammunition Wagons—*contd.*

| Details. | Gun Carriage, Land Service—*contd.* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 25-pr. R.M.L. | | 40-pr. R.M.L. | | | 6·3″ R.M.L. Howitzer. | 6·6″ R.M.L. Howitzer. | 8″ R.M.L. Howitzer of 70 cwt. | 6·6″ R.M.L. gun. |
| | Field. | Overbank. | Mark I. | Mark II. | Overbank. | | | | |
| | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. | ft. ins. |
| Maximum length with gun | 24 2¾ | — | 23 11 | 25 0 | — | 25 0 | — | — | — |
| Maximum length without gun | 19 9½ | — | 21 1¼ | 21 2 | — | 21 2 | 21 2 | 21 2 | — |
| Maximum width | 6 3½ | 6 3½ | 6 3½ | 6 3½ | 6 3½ | 6 3½ | 6 3½ | 6 3½ | — |
| Track of wheels | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 | 5 2 |
| Diameter of wheels | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 5 0 | 6 0 |
| Length between axles | — | — | 10 1¼ | 10 1¼ | 10 1¼ | 10 1¼ | 10 1¼ | 10 1¼ | 8 4—firing |
| Height to axis of trunnions | 3 10 | 6 3 | 4 5 | 4 5 | 6 6 | 4 5 | 4 5 | 4 5 | 5 0—loading |
| Space required to turn in | 33 9 | 33 9 | 36 1 | 36 3½ | 36 3½ | 36 3½ | 36 3½ | — | 4 4—travelling |
| Angle of trail with ground | 23° | 23° | 20° | 20° | 20° | 20° | 20° | 19° | — |
| Angle of lock | 51° | 51° | 49½° | 49½° | 49½° | 49½° | 49½° | 49½° | — |
| Maximum elevation for gun | 45° | 35° | 38° | 38° | 35° | 41⅓° | 35° | 35° | 12° |
| Maximum depression for gun | 5° | 20° | 11¼° | 11¼° | 20° | 11½° | 5° | 5° | 5° |
| Upsetting angle packed | 37° | 28° | 31½° | 30° | 27½° | — | 30° | — | — |
| | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs. | cwts. qrs. lbs |
| Pressure of trail on ground, packed | 3 0 6 | 4 1 5 | 4 1 9 | 6 3 8 | 6 2 14 | — | | | |
| Pressure of shafts on horse, packed | 0 2 10 | — | 0 2 20 | 0 2 12 | — | — | | | |
| Pressure of fore wheels on ground | 18 2 14 | 22 3 10 | 26 1 10 | 28 3 20 | 30 3 7 | — | | | |
| Pressure of hind wheels on ground | 32 3 7 | 34 2 10 | 54 1 12 | 58 3 0 | 66 1 21 | — | | | |
| Number of rounds carried | 22 | 18 | 12 | 12 | 0 | 0 | | | |

## Appendix E.—Details of Gun Carriages and Ammunition Wagons—*continued.*

| Details. | Wagons, Land Service. | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7-pr. R.M.L. Colonial. | | 9-pr. R.M.L. Ammunition. | | | | 13-pr. R.M.L. | | 16-pr. R.M.L. Ammunition. | | | | 12-pr. B.L. | | 25-pr. R.M.L. Ammunition. | | 40-pr. R.M.L. Ammunition. | | Forge Wagon. | | | | Store wagon. | |
| | | | Mark I. | | Mark II. | | | | Mark I. | | Mark II. | | | | | | | | Mark I. | | Mark II. | | | |
| | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. |
| Maximum length with gun ... ... ... | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | |
| Maximum length without gun ... ... | 19 | 3½ | 20 | 5¾ | 20 | 7½ | 20 | 11 | 20 | 5½ | 20 | 7½ | — | | 20 | 7½ | 20 | 7½ | — | | — | | — | |
| Maximum width ... ... ... ... | 6 | 1 | 6 | 3½ | 6 | 3½ | 6 | 3¾ | 6 | 3½ | 6 | 3½ | — | | 6 | 3½ | 6 | 3½ | 6 | 3½ | 6 | 3½ | 6 | 3½ |
| Track of wheels ... ... ... ... | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 |
| Diameter of wheels ... ... ... ... | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 |
| Length between axles ... ... ... | 7 | 0 | 7 | 7¾ | 7 | 9¾ | — | | 7 | 7¾ | 7 | 9¾ | — | | 7 | 9¾ | 7 | 9¾ | 7 | 7¾ | 7 | 9¾ | 7 | 9¾ |
| Height to axis of trunnions ... ... | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | |
| Space required to turn in ... ... ... | 30 | 6 | 29 | 8½ | 29 | 6½ | 28 | 11 | 29 | 8½ | 29 | 6½ | — | | 29 | 6½ | 29 | 6½ | 29 | 8½ | 29 | 6½ | 29 | 6½ |
| | ° | | ° | | ° | | ° | | ° | | ° | | ° | | ° | | ° | | ° | | ° | | ° | |
| Angle of trail with ground... ... ... | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | |
| Angle of lock ... ... ... ... | 45 | | 54¾ | | 58½ | | — | | 54¾ | | 58½ | | — | | 58½ | | 58½ | | 54¾ | | 58½ | | 58½ | |
| Maximum elevation for gun ... ... | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | |
| Maximum depression for gun ... ... | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | |
| Upsetting angle, packed ... ... ... | — | | 35½ | | 32½ | | — | | 35½ | | 33 | | — | | 33½ | | — | | 32 | | 33½ | | 34 | |
| | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. |
| Pressure of trail on ground, packed ... | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | | — | |
| Pressure of shafts on horse, packed ... | — | | 0 | 2 3 | 0 | 2 12 | — | | 0 | 2 8 | 0 | 2 4 | 0 | 2 12 | 0 | 1 26 | — | | 0 | 2 0 | — | | — | |
| Pressure of fore wheels on ground ... | — | | 17 | 0 15 | 17 | 2 6 | — | | 17 | 2 0 | 17 | 3 14 | 10 | 3 11 | 18 | 0 20 | — | | 10 | 1 24 | — | | — | |
| Pressure of hind wheels on ground ... | — | | 23 | 2 17 | 32 | 2 10 | — | | 23 | 2 19 | 23 | 3 10 | 9 | 2 8 | 24 | 0 8 | — | | 16 | 2 24 | — | | — | |
| Number of rounds carried ... ... ... | 180 | | 108 | | 108 | | — | | 72 | | 72 | | 72 | | 54 | | 36 | | — | | — | | — | |
| | | | | | | | | | | | | | | | | | | | | | | | — | |

## Appendix E.—Details of Gun Carriages with Ammunition Wagons—*contd.*

| Details. | Gun Carriages, Sea Service. | | | |
|---|---|---|---|---|
| | 9-pr. R.M.L. 6 cwt. | 9-pr. R.M.L. 8 cwt. | 9-pr. R.M.L. (steel carriage). | ·45″ Gatling. |
| | ft. ins. | ft. ins. | ft. ins. | ft. ins. |
| Maximum length with gun | — | — | — | — |
| Maximum length without gun | — | — | — | — |
| Maximum width | 4 8½ | 4 8½ | 4 8 | 4 4½ |
| Track of wheels | 3 7 | 3 7 | 3 6 | 3 6½ |
| Diameter of wheels | 3 6 | 3 6 | 3 6 | 3 6 |
| Length between axles | 7 4 | 7 4 | — | 6 3¾ |
| Height to axis of trunnions | 3 3½ | 3 2 | 2 9 | 3 0 |
| Space required to turn in | 25 2 | 25 2 | — | 22 11 |
| | ° | ° | ° | ° |
| Angle of trail with ground | 19 | 19 | 22 | 16½ |
| Angle of lock | 55 | 55 | — | 48 |
| Maximum elevation for gun | 15 | 12 | 12 | 30 |
| Maximum depression for gun | 6 | 10½ | 8 | 50½ |
| Upsetting angle, packed | — | 32¾ | 31 | — |
| | — | cwts. qrs. lbs. | cwts. qrs. lbs. | — |
| Pressure of trail on ground, packed | — | 1 0 6 | 1 0 4 | — |
| Pressure of shafts on horse, packed | — | 0 0 13 | — | — |
| Pressure of fore wheels on ground | — | 9 1 23 | — | — |
| Pressure of hind wheels on ground | — | 14 2 22 | 14 2 | — |
| Number of rounds carried | 24 | 24 | — | 1,440 |

# APPENDIX F.

## Details of Engineer and Transport Wagons and Carts

| Details | Wagons. | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R.A. Ammunition and Store. Mark II. | | Artillery. | | Platform. | | Pontoon. | | Office. | | R.E. General Service. | | Air Line. | | | | | | | | | | | |
| | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | | | | | | | | | | |
| Length, inside | 9 | 8 | 11 | 0 | — | | — | | 5 | 6½ | 9 | 8 | — | | | | | | | | | | | |
| Width, inside | 3 | 8 | 3 | 6 | — | | — | | 4 | 1⅝ | 3 | 8 | — | | | | | | | | | | | |
| Depth, inside | 1 | 8 | 1 | 2⅝ | — | | — | | 4 | 10¼ | 1 | 11¼ | — | | | | | | | | | | | |
| Maximum width | 6 | 3½ | 3 | 6¼ | — | | 6 | 9 | 6 | 1 | 6 | 1 | 6 | 1 | | | | | | | | | | |
| Track of wheels | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 10 | 5 | 2 | 5 | 2 | 5 | 2 | | | | | | | | | | |
| Diameter of fore wheels | 3 | 4 | 3 | 6 | 4 | 0 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | | | | | | | | | | |
| Diameter of hind wheels | 5 | 0 | 5 | 0 | 5 | 0 | 4 | 8 | 4 | 8 | 4 | 8 | 4 | 8 | | | | | | | | | | |
| Length between axles | 5 | 11¾ | 7 | 6 | 6 | 11¼ | 10 | 0 | 5 | 11¼ | 5 | 11¼ | 9 | 1½ | | | | | | | | | | |
| Space required to turn in | 23 | 7 | 29 | 2 | 35 | 6 | 21 | 8 | 23 | 2 | 23 | 6 | 19 | 0 | | | | | | | | | | |
| Angle of lock | 103° | | 119° | | 37⅓° | | 107° | | 103¼° | | 105¼° | | 98° | | | | | | | | | | | |
| Upsetting angle, empty | 30° | | 29½° | | 40½° | | — | | — | | — | | 31° | | | | | | | | | | | |
| | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. | cwts. | qrs. | lbs. |
| Pressure of shafts on horse, empty | 0 | 0 | 25 | 0 | 0 | 24 | 0 | 1 | 8 | 0 | 0 | 25 | 0 | 0 | 25 | 0 | 0 | 25 | 0 | 0 | 25 | | | |
| Pressure of fore wheels on ground, empty | — | | | 6 | 3 | 11 | 17 | 2 | 14 | 8 | 2 | 8 | 9 | 3 | 19 | 11 | 1 | 20 | 11 | 2 | 6 | | | |
| Pressure of hind wheels on ground, empty | — | | | 7 | 1 | 6 | 14 | 3 | 8 | 7 | 2 | 3 | 12 | 2 | 2 | 9 | 1 | 25 | 9 | 3 | 2 | | | |
| Load | 40 | 0 | 0 | 15 | 0 | 0 | 64 | 0 | 0 | — | | | — | | | 30 | 0 | 0 | — | | | | | |
| Capacity | 59·00 cub. ft. | | | 43·457 | | | — | | | — | | | 141·00 cub. ft. | | | 68·67 cub. ft. | | | — | | | | | |

## Appendix F.—Details of Engineer and Transport Wagons and Carts—*contd.*

| Details. | Wagons. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Timber. | | General Service IV. | | Transport. | | Bread and Meat. | | Ambulance III. | | Pharmacy. | |
| | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. |
| Length, inside | — | | 9 | 8 | 11 | 0 | 10 | 4 | 9 | 5½ | — | |
| Width, inside | — | | 3 | 8 | 3 | 2 | 3 | 11 | 4 | 3¼ | — | |
| Depth, inside | — | | 1 | 8 | 1 | 4 | 2 | 9½ | 1 | 8 | — | |
| Maximum width | 6 | 3½ | — | | — | | — | | 6 | 1½ | 6 | 1½ |
| Track of wheels | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 | 5 | 2 |
| Diameter of fore wheels | 3 | 4 | 3 | 4 | 3 | 9 | 3 | 6 | 3 | 0 | 3 | 0 |
| Diameter of hind wheels | 4 | 8 | 4 | 8 | 4 | 8 | 5 | 0 | 4 | 8 | 4 | 8 |
| Length between axles | 16 | 9 | 5 | 11¾ | 6 | 8 | — | | — | | 5 | 11½ |
| | 10 | 9 | | | | | | | | | | |
| Space required to turn in | 45 | 2 | 23 | 8 | 39 | 0 | — | | — | | 22 | 10 |
| | 33 | 0 | | | | | | | | | | |
| Angle of lock | 55° | | — | | 26½° | | 90° | | — | | 98° | |
| Upsetting angle, empty | — | | — | | 29° | | — | | — | | 35½° | |
| | | | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. |
| Pressure of shafts on horse, empty | — | | — | | — | | — | | — | | 0 | 0 24 |
| Pressure of fore wheels on ground, empty | — | | — | | 8 | 3 19 | — | | — | | 5 | 2 18 |
| Pressure of hind wheels on ground, empty | — | | — | | 5 | 3 9 | — | | — | | 7 | 2 3 |
| Load | — | | 30 | 0 0 | — | | 40 | 0 0 | — | | — | |
| Capacity | — | | 59·00 cub. ft. | | | | 163·67 cub. ft. | | — | | — | |

## Appendix F.—Details of Engineer and Transport Wagons and Carts—*contd.*

| Details. | Carts. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hand. | | Trench. | | Small Arm Ammunition. | | Tip G.S. | |
| | ft. | ins. | ft. | ins. | ft. | ins. | ft. | ins. |
| Length, inside | 4 | 6 | 4 | 3 | — | | 5 | 6 |
| Width, inside | 2 | 11 | 2 | 7 | — | | 3 | 4½ |
| Depth, inside | 1 | 3 | 1 | 0 | — | | 1 | 9 |
| Maximum width | 5 | 3½ | 5 | 8 | — | | — | |
| Track of wheels | 4 | 5½ | 4 | 3½ | 5 | 2 | 5 | 2 |
| Diameter of fore wheels | 4 | 2 | 4 | 2 | 5 | 0 | 4 | 8 |
| Diameter of hind wheels | — | | — | | — | | — | |
| Length between axles | — | | — | | — | | — | |
| Space required to turn in | — | | — | | — | | — | |
| Angle of lock | — | | — | | — | | — | |
| Upsetting angle, empty | — | | — | | 35° | | — | |
| | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. | cwts. | qrs. lbs. |
| Pressure of shafts on horse, empty | — | | — | | 0 | 1 11 | 0 | 1 21 |
| Pressure of fore wheels on ground, empty | — | | — | | 8 | 0 17 | 8 | 1 10 |
| Pressure of hind wheels on ground, empty | — | | — | | — | | — | |
| Load | 15 | 0 0 | 20 | 0 0 | 15 | 0 0 | 15 | 0 0 |
| Capacity | 16·40 cub. ft. | | 10·98 cub. ft. | | — | | 32·48 cub. ft. | |

# APPENDIX G.

**4484.—Carriages, garrison, sliding, medium.**

**Platforms, traversing, medium.**

The following nomenclature for carriages and platforms for rifled M.L., 7-inch, 6½-ton gun for 6 feet parapet, and 40-pr.: B.L. 40-pr. and 20-pr.; also smooth-bore B.L. 32-pr., and all medium guns has been approved instead of that hitherto employed.

CARRIAGES.

| New nomenclature. | | | Previous designation. |
|---|---|---|---|
| Official designation. | | Additional particulars. | |
| **Carriage, garrison, sliding, medium,** | **No. 1.** | Iron, B.L., 7-inch, 82-cwt., 4 feet 3-inch, 3-feet 6-inch, or 2-feet, 7-inch parapet, for platforms, Nos. 1, 2, and 3 (converted naval rifled M.L., 7-inch, 6½ tons). | (*Vocabulary* 1882.) Carriage, garrison, complete, wrought-iron, sliding, double plate rifled B.L. 7-inch, 82 cwt § 4003. |
| ,, | **No. 2.** | Iron, B.L., 7-inch, 82 cwt., 4-feet 3-inch or 3-feet 6-inch parapet, for platforms Nos. 11 and 12. | (§ 4210.) Carriage, garrison, complete, wrought-iron, sliding, single plate, B.L. 7-inch, 82 cwt., 4-feet 3-inch or 3-feet 6-inch parapet. Mark I. |
| ,, | **No. 3.** | Iron, B.L., 7-inch, 82 cwt., 3-feet 6-inch parapet, for 11-feet platform No. 13. | (§ 4209.) Carriage, garrison, complete, wrought-iron, sliding, single plate, B.L. 7-inch, 82 cwt., for 11-feet platform, 3-feet 6-inch parapet, Mark I. |
| ,, | **No. 4.** | Iron, B.L., 40-pr., for platform No. 4. | (§ 4235.) Carriage, garrison, wrought-iron, sliding, rifled B.L., 40-pr., Mark I |
| ,, | **No. 5.** | Iron, B.L., 20-pr., for platform No. 5. | (§ 4211.) Carriage, garrison wrought-iron, sliding, rifled B.L. 20-pr.. Mark I. |
| ,, | **No. 6.** | Iron, S.B,B.L., 32-pr., for platform No. 6. | (*Vocabulary*, 1882.) Carriage garrison, complete, wrought-iron, sliding, single plate, S. B. B.L., 32-pr. 42 cwt., § 4059. |
| ,, | **No. 7.** | Iron, rifled M.L., 7-inch, 6½ tons, 6-feet parapet, for platform No. 7. | (*Vocabulary*, 1882.) Carriage, garrison, complete, wrought-iron, sliding, double plate, rifled M.L., 7-inch, 6½ tons. § 3986. |
| ,, | **No. 8.** | Iron, rifled M.L., 64-pr., 64 cwt., Mark III gun, 6-feet parapet, for platform No. 8. | (*Vocabulary*, 1882.) Carriage, garrison, complete, wrought-iron, sliding, single plate, rifled M.L., for circular buffer, 64-pr. 64 cwt., Mark III gun 6 feet parapet. § 3861. |
| ,, | **No. 9.** | Iron, rifled M.L., 64-pr., 64 cwt., 5-feet 6-inch parapet, for platform No. 9. | (*Vocabulary*, 1882.) Carriage, garrison, complete, wrought-iron, sliding, single plate, rifled M.L. 64-pr. 64 cwt., 5-feet 6-inch parapet, § 3834. |
| ,, | **No. 10.** | Iron, rifled M.L., 64-pr. 71 cwt. 4-feet 3-inch, or 3-feet 6-inch parapet, for platforms Nos. 11. and 12. | *(Not published in List of Changes, or given in Vocabulary.)* |

CARRIAGES—*cont.*

| New nomenclature. | | | Previous designation. |
|---|---|---|---|
| Official designation. | | Additional particulars. | |
| Carriages, garrison, sliding, medium, | No. 11. | Iron, rifled M.L., 64-pr., 71 cwt., 3-feet 6-inch parapet, for 11-feet platform No. 13. | (*Not published in List of Changes or given in Vocabulary.*) |
| ,, | No. 12. | Iron, rifled M.L., 64-pr., 71 cwt., 2-feet 7-inch parapet, for platform No. 19. | (*Do. do.*) |
| ,, | No. 13. | Iron, rifled M.L., 64-pr., 58 cwt., 4-feet 3-inch, or 3-feet 6-inch parapet, for platforms Nos. 11 and 12. | (§ 4212.) **Carriage, garrison, complete, wrought-iron, sliding, single plate, rifled M.L. $\frac{64}{32}$-pr. 58 cwt., 4 feet 3-inch, or 3-feet 6-inch parapet, Mark I.** |
| ,, | No. 14. | Iron, rifled M.L., 40-pr., for platform No. 10. | (*Not published in List of Changes, or given in Vocabulary.*) |
| ,, | No. 15. | Wood, B.L., 7-inch, 82 cwt., casemate, for platform No. 14. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding, casemate, gun, rifled B.L. 7-inch.** § 416. |
| ,, | No. 16. | Wood, B.L., 7-inch, 82 cwt., dwarf, for platform No. 16. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding dwarf, gun, rifled, B.L. 7-inch heavy.** § 346. |
| ,, | No. 17. | Wood, B.L., 7-inch, 72 cwt., dwarf, for platform No. 16. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding, dwarf, gun, rifled B.L. 7-inch light.** § 677. |
| ,, | No. 18. | Wood, B.L., 7-inch, 72 cwt. (converted naval), for platform No. 15. | (*Vocabulary*. 1882.) **Carriage, travelling, complete, wood, siege, equipment, rifled B.L. 7-inch** (*see* carriages, wood, naval, complete, sliding, 7-inch 72 cwt. |
| ,, | No. 19. | Wood, B.L., 40-pr., casemate, for platform No. 14. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding, casemate, gun, rifled B.L. 40-pr.** § 613. |
| ,, | No. 20. | Wood, B.L., 40-pr., dwarf, for platform No. 17. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding dwarf, gun rifled B.L. 40-pr.** |
| ,, | No. 21. | Wood, rifled M.L., 80-pr., 5 tons, casemate, also S.B., 68-pr., 95 cwt., for platform No. 14. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding, casemate, gun, rifled M.L. $\frac{80}{68}$-pr. or S.B. 68-pr. 95 cwt.** |
| ,, | No. 22. | Wood, rifled M.L., 80-pr., 5 tons, dwarf, for platforms Nos. 16 17 and 18, also S.B., 68-pr., 95 cwt., for platform No. 17. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding, dwarf, gun, rifled M.L. $\frac{80}{68}$-pr.** |
| ,, | No. 23. | Wood, rifled M.L., 64-pr., 71 cwt. dwarf, for platforms Nos. 16 and 18 also S.B., 8-inch, 65 cwt., or 60 cwt., for platform No. 17. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, wood, sliding, dwarf, gun, rifled M.L. $\frac{64\text{-pr.}}{8\text{-inch}}$ 71 cwt. and S.B. 8-inch 65 or 60 cwt.** |
| ,, | No. 24. | Wood, rifled M.L., 64-pr., 58 cwt., dwarf, for platforms Nos. 16 and 18 also S.B., 32-pr., 58 cwt. or 56 cwt., for platform Nos. 17. | (*Vocabulary*, 1882.) **Carriage, garrison, complete, sliding, dwarf, gun, S.B. 32-pr. 58 or 56 cwt.** |
| ,, | No. 25. | Wood, rifled M.L. 64-pr., 58 cwt., casemate, and haxo for platform No. 14. | (*Not published in List of Changes or given in Vocabulary.*) |

| New nomenclature. | | | Previous designation. |
|---|---|---|---|
| Official designation. | | Additional particulars. | |
| Plattorm, traversing, medium, | No. 1. | Iron, B.L., 7-inch, 82 cwt., 4-feet 3-inch parapet, for carriage No. 1 (converted slide). | (*Not published in List of Changes or given in Vocabulary.*) |
| ,, | No. 2 | Iron B.L., 7-inch, 82 cwt., 3-feet 6-inch parapet, for carriage No. 1 (converted slide). | (*Vocabulary*, 1882.) Platform, wrought-iron, traversing, rifled B.L. 7-inch 82 cwt. 3-feet 6-inch parapet. § 4003. |
| ,, | No. 3. | Iron, B.L., 7-inch, 82 cwt., 2-feet 7-inch parapet, for carriage No. 1 (converted slide). | (*Not published in List of Changes or given in Vocabulary.*) |
| ,, | No. 4. | Iron, B.L., 40-pr., for carriage No. 4. | (§ 4235.) Platform, wrought-iron, traversing, rifled B.L. 40-pr., Mark I. |
| ,, | No. 5. | Iron, B.L., 20-pr., for carriage No. 5. | (§ 4211.) Platform, wrought-iron, traversng, rifled B.L. 90-pr., Mark I. |
| ,, | No. 6. | Iron, S.B., B.L., 32-pr. for carriage No. 6. | (*Vocabulary*, 1882.) Platform, wrought-iron, traversing, single plate, carriage, S.B., B.L. 32-pr. 42 cwt. § 4059. |
| ,, | No. 7. | Iron, rifled M.L., 7-inch, 6½ tons, 6-feet parapet, for carriage No. 7. | (*Vocabulary*, 1882.) Platform, wrought-iron, traversing, rifled M.L. 7-inch 6½-tons 6-feet parapet. § 3986. |
| ,, | No. 8. | Iron, rifled M.L., 64-pr., 64 cwt., Mark III. gun, 6-feet parapet, for carriage No. 8. | (*Vocabulary*, 1882). Platform, wrought-iron, traversing, with circular buffer, rifled M.L. 64-pr. 64 cwt., Mark III. gun, 6-feet parapet, § 3861. |
| ,, | No. 9. | Iron, rifled M.L. 64-pr., 64 cwt., 5-feet 6-inch parapet, for carriage No. 9. | (*Vocabulary*, 1882.) Platform, wrought-iron, traversing, rifled M.L. 64-pr. 64 cwt, 5-feet 6-inch parapet, § 3834. |
| ,, | No. 10. | Iron, rifled M.L., 40-pr., for carriage No. 14. | (*Not published in List of Changes or given in Vocabulary.*) |
| ,, | No. 11. | Wood, B.L., 7-inch, 82 cwt., rifled M.L., 64-pr., 71 and 58 cwt., 4-feet 3-inch parapet, for iron carriages Nos. 2, 10, and 13 (13-feet 2-inches long). | (§§ 5210, 4210.) Platform, wood, traversing, for wrought-iron carriages, rifled M.L., $\frac{64}{32}$-pr. 58 cwt. and B.L. 7-inch 82 cwt., 4 feet 3 inch parapet, Mark I. |
| ,, | No. 12. | Wood, B.L., 7-inch, 82 cwt., rifled M.L., 64-pr., 71 and 58 cwt., 3-feet 6-inch parapet, for iron carriages Nos. 2, 10, and 13 (13 feet 2 inches long). | (§§ 4210, 4212.) Platform, wood, traversing, for wrought-iron carriages, rifled M.L., $\frac{64}{32}$-pr. 58 cwt., and B.L. 7-inch, 82 cwt., 3 feet-6-inch parapet, Mark I. |
| ,, | No. 13. | Wood, B.L., 7-inch, 82-cwt., rifled M.L., 64-pr., 71 cwt., 3-feet 6-inch parapet, for iron carriages Nos. 3 and 11 (11-feet long). | (§ 4209.) Platform, wood, traversing. casemate, 11-feet, for wrought-iron carriage, B.L., 7-inch, 82 cwt., 3-feet 6-inch parapet, Mark I. |
| | No. 14. | Wood, B.L., 7-inch and 40-pr., rifled M.L., 80-pr. 5 tons, also for all S.B. guns, casemate 64-pr. 58 cwt. for wood carriages Nos. 15, 19, 21 and 25 (16 feet long). | *Vocabulary*, 1882.) Platform, wood, traversing, casemate, rifled and S.B. guns. |

PLATFORMS—*cont.*

| New nomenclature. | | Previous designation. |
|---|---|---|
| Official designation. | Additional particulars. | |
| **Platform, traversing, medium, No. 15.** | Wood, B.L., 7-inch, 72-cwt. (converted slide), for wood carriage No. 18. | *Vocabulary*, 1882.) **Slide, wood siege equipment, rifled B.L. 7-inch.** |
| ,, **No. 16.** | Wood, B.L., 7-inch, rifled M.L., 80-pr. 5 tons, and 64-pr. dwarf, for wood carriages Nos. 16, 17, 22, 23, and 24 (16-feet long). | (*Vocabulary*, 1882.) **Platform, wood, traversing, dwarf, rifled B.L., 7-inch, and rifled M.L., 80 and 64-pr.,** § 3576. |
| ,, **No. 17.** | Wood, B.L,, 40-pr. and S.B. guns. dwarf, for wood carriages Nos. 20, 22, 23, and 24 (16 feet long) also for R.M.L. A and B pivots only. | (*Vocabulary*, 1882.) **Platform, wood, traversing, dwarf, rifled B.L., 40-pr., and S.B. guns.** |
| ,, **No. 18.** | Wood, rifled M.L., 80-pr., 5 tons, 64-pr., 71 cwt. and 58 cwt., 6-feet parapet, for wood carriages Nos. 22, 23, and 24 (16-feet long). | (*Not before published in List of Changes or given in Vocabulary.* See § 4485.) |
| ,, **No. 19.** | Wood, rifled M.L., 64-pr., 71 cwt. 2-feet 7-inch parapet, for iron carriage No. 12\|(13-feet 2-inches long). | (*Do. do.*) |

In order to prevent mistakes in issues, arising from clerical errors, &c., all demands for carriages or platforms in the above list must contain, in addition to the designation, so much additional information from the second column as will identify the service for which the article is required.

For example—

Carriage, garrison, sliding, medium, No. 2.
Platform, traversing, medium, No. 11.
} For B.L., 7-inch, 82 cwt., 4-feet 3-inch parapet.

# APPENDIX H.

## Carriage, Siege, B.L., 5″, 6′ Parapet.*

The carriage consists of two brackets, trail eye, axletree, and wheels.

The brackets are of the lattice girder construction, similar to those of the carriage for the R.B.L. 40-pr. gun, fig. 20, p. 92, but are made of steel. They are connected by stays in front, by the axletree, two steel transoms, a top plate, and the trail eye.

The axletree is a solid steel bar formed with an opening at the centre, through which passes the cylinder of a hydraulic buffer. The axletree is connected with the trail by wrought-iron bearings and by wrought-iron tensile stays as in the 40-pr. carriage.

When in action the hydraulic buffer is inclined at an angle of about 45°, a loop on the end of the piston rod is secured to the radial arm of pivot plate; the buffer cylinder is supported in the opening in the axletree, and is attached to the carriage by steel bars, which loop over trunnions on the front cap, and are secured by steel pins to loops formed on the bearings connecting the brackets and axletree.

For travelling, the piston rod of the buffer is disconnected from the pivot, and the bars from the loops at the axletree; the buffer is pushed through the axletree to the rear, the rear end of the cylinder passing through the transom, and being supported on a bar of angle iron connecting the brackets beneath it. The front of the buffer is supported by the bars attached to the front cap, the upper ends of which are connected by pins to metal brackets on the breast of the carriage. A chain attached to the front of the left bracket is passed through tho loop on the piston rod, and the end made fast to the right bracket.

The carriage has the following fittings :—

Worm-wheel and friction cone elevating gear at the right side, giving 25° elevation and 5° depression.

Travelling trunnion bearings of wrought-iron; capsquares; loops for shifting tackle; trail handles; a hinged wood step at each side; and a removable step on the trail in front of the eye.

The wheels are 1st class B, 5′ diameter with steel tires.

## Air-Line Wagon.

The body of this wagon consists of two sides connected by front and rear earbed, bolsters, and a cross bar. A rave is supported over each side and 9½″ above it by five standards, and is secured by bolts. A floor is formed over the raves by slats.

Two boxes—length 4′ 3″, depth 21¼″, width of front box 19″,

* An exactly similar carriage is designed for the 4″ B.L. gun.

of hind 24″—are secured on this floor, one at the front, and one over the hind axle.

The space between the raves and sides is closed in front by an end board lined with sheet iron. To support the rear ends of the poles, which are carried beneath the floor, there is a waterproofed canvas attached to the standards and earbed. The canvas is also attached to a hind board, which can be connected with the rear end of the floor by three straps.

The fore carriage, springs, wheels, &c., are the same as for the other engineer carriages.

### Telegraph Poles, Fir.

Poles. § 3706. § 5122.

The poles for ordinary air line equipment are of fir or bamboo. The fir poles are 13′, Marks I and II intermediate, 8′ and 15′.

The pole 13′ intermediate Mark I is made of fir $1\frac{1}{2}$″ diameter at top and 2″ at foot, ferruled with 1″ band of No. 16 gauge iron, brazed at top and shod with wrought-iron conical screw. It is painted with black and white rings, and the iron work is blacked.

The Mark II pole is similar to Mark I, but a hole is bored in the top to carry the insulator, and the lower end is not cut with a shoulder for the iron shoe. A small proportion of these poles are carried with the bamboo poles for angles and long spans.

The 8′ fir pole is $1\frac{1}{2}$″ diameter throughout, and is ferruled at one end. It is painted white and black in rings and the iron work is blacked. It is used with the before-mentioned for crossings, &c.

The 15′ pole is in two pieces, which are scarfed at the joint ends, and are connected by a steel tube, which is fixed by wood screws to the top piece. A hole for the insulator is bored in the top of the pole, and an iron ferrule fitted to prevent it splitting. The lower end is pointed to facilitate its insertion in the ground.

The pole is tapered, the greatest diameter (2′ 6″ from the ground) being $2\frac{3}{4}$″, and the smallest diameter 2″.

A number of poles have been issued with wired instead of ferruled tops.

The 15′ poles are used for special requirements and pack transport.

### Transport Wagon, Mark II.

The body of this waogn is built up of longitudinal boards and cross bars, and is separate from but rests on the under carriage. It is furnished with floating raves, a driver's seat, a socket for the whip, and a locker under the foot board. The sides will not fold down, but the raves and seat are removable.

The end rave staves are each made with a nib at the end, which fits in a recess in the side stays, in which position it is kept by a leather strap riveted on the rave stay for the purpose.

The driver's seat is supported on springs fixed on standards, excessive play of the springs being checked by straps, which connect the seat to a cross bar on the under side.

The footboard forms the top of the locker, access to which is given by a small door hinged to the front.

The under carriage consists of a perch, connected by a pin to guide

stays, which are fixed between the rear bolster and axletree. The perch is pivoted to the front axletree by the main pin.

The lock is limited by chains, which prevent the wheels damaging the body when turning, and the sway of the body is limited by the locking bars.

Iron standards fixed to the bolsters of the under carriage, and wood cross bars fixed to the body, keep the latter in position on the under carriage when travelling.

The splinter bar is bolted to the top of the futchells, and strengthened by iron stays, which are formed with loops at the front, for the attachment of the swingletrees.

A sweep bar fixed to the futchells bears against the perch and prevents the fore carriage tilting forwards.

The pole is connected to the futchells by a horizontal pin; a single loop is fitted to the point for the pole chains.

The wheels are third class B, with wood naves and phosphor-bronze pipes; fore, No. 166, 3′ 9″ in diameter; hind, No. 165, 4′ 8″ diameter.

The wagon is fitted with a brake, which consists of a hand lever on the right side connected by a rod to a brake lever, furnished with a block of wood to act upon the off hind wheel. The brake lever is fixed to an iron cross bar, which has a similar lever fixed on its other extremity to act upon the near wheel.

The brake is supplemented by a drag shoe, the chain of which is fitted with a hook.

Six wagons Mark I have been issued; they resemble Mark II, but the body is framed and rigidly attached to the under carriage.

The wheels are third class B, with wood naves and phosphor-bronze pipes, fore, No. 155, 4′ diameter; hind, No. 147, 4′ 8″ diameter.

### 100-Ton R.M.L. Barbette Mountings.*

Four of these mountings are erected at Gibraltar and Malta, two at each station. The front part of the platform is pivoted to, and rests on a strong cast-iron pivot secured to the work, the rear part only has trucks. Hydraulic gear is used to traverse, elevate, and load the gun, the power being obtained from an accumulator worked by steam pumps.

### 10·4″ R.M.L. Barbette Mounting.*

Several of these mountings have been made, they resemble the 100-ton R.M.L. mounting, but are worked by ordinary hand gear, and are traversed for loading at a fixed position at the side of the work the gun is depressed and the rammer is worked by hand gear.

### 10″ B.L. Barbette Mountings.*

This mounting, designed at Elswick, resembles that of the 10·4″ R.M.L. gun, but has front as well as rear trucks, it is loaded in any position with the gun run back and elevated to 15.°

Another description of barbette mounting for this gun, designed in the Royal Carriage Department, is under manufacture, its chief feature is having a jointed rear support to ths platform, intended to

* Detailed descriptions of the various mountings will be found in their respective handbooks.

do away with the jump of the front end on the discharge of the gun, and thus to dispense with the need of holding down clips. The pivot is constructed to control the movement of traversing and not to take any of the strain of recoil.

### 9·2″ B.L. Barbette Mountings.*

The mountings for the 9·2″ B.L. gun, are of two descriptions, as in the case of the 10″ B.L. which they resemble in all respects.

### 8″ B.L. Barbette Mounting.*

Several of these are mounted at Singapore, they have a centre pivot, are worked by hand gear and are fitted with Vavasseur hydraulic buffers for controlling the recoil, the trucks are flat soled and the strain of recoil is borne entirely by the central pivot.

### H.P. Mountings for B.L. 6″ Gun, Marks IV and V.

Some mountings of the above description have been made for Mark IV gun, differing from those for Mark V gun (p. 287) principally in the following points, viz. :—

1. Construction of recoil cylinder.
2. In having a "live roller ring," and no pivot.
3. The traversing gear.

Recoil cylinder.

1. The recoil cylinder has eleven chambers or reservoirs surrounding the central or recoil chamber, in which a hollow ram of manganese bronze works.

The outer reservoirs are in communication with each other by means of passages leading into a common chamber at the lower end of the cylinder, and with the central chamber by means of the recoil and raising valves, the former being opened only during recoil. When the gun is to be raised, the latter is worked by hand by means of a wrought-iron lever, and closed automatically at the end of the up stroke by a chain which is attached to the lever and brackets of the elevator.

The lowering pump is attached to the cylinder. It is a double-acting piston pump worked by means of a lever handle on the outside of the platform.

By means of this pump water can be forced from the inner chamber to the outer chambers when the gun is in the firing position; thereby the ram is allowed to fall, and the gun brought down to the loading position.

Live roller ring.

2. The platform is supported and traversed on a plan frequently adopted for turrets.

16-flanged rollers are kept in position in a detached ring by steel axles. They run on a circular racer, and segments of similar section under the front and rear of the platform rest on them. This arrangement greatly facilitates traversing.

Traversing gear.

3. The traversing is effected by two pinions which gear into teeth formed round the outside of the racer.

The spindles of the pinions pass up through pedestals bolted to

* Detailed descriptions of the various mountings will be found in their respective handbooks.

the platform, and have on their upper ends bevel wheels into which gear pinions traversed by handwheels.

Minor points of difference are :—

1. Attachment of ram to cross-head in elevator. Nut with saucer springs instead of cotter.
2. Retaining chains dispensed with.
3. 20° elevation instead of 15°.
4. Clip ring forms part of racer.
5. Two sighting ladders and platforms instead of one.
6. Two retaining links to secure gun in loading position when pumping in pressure.

Mountings for both Marks IV and V guns have been made of a pattern which differs from the foregoing in some small details. Chiefly in having larger cylinders and air chambers and a greater number of teeth in the traversing rack.

### 9·2″ and 10″ B.L. Disappearing H.P. Mountings.

Mountings of this description, designed at Elswick on the general plan of the 6″ B.L. H.P. mounting described on page 287 are under trial. Also similar mountings designed by Easton and Anderson, but differing from the foregoing in having fixed H.P. apparatus in the platform, the hydraulic pistons being connected with the lower ends of the elevators by suitable connecting rods.

### Machine Gun Mountings.

Light field carriages for machine guns for infantry and cavalry are under trial, they resemble light field limbers, have frames for the ammunition and fittings to mount the guns.

### Instructions for Care of Rear Roller Hydraulic Jacks.

A moderate pressure must be constantly maintained on the leather packings of the hydraulic jacks, to preserve them in good condition and prevent leakage. With this object when in use as part of the carriage, the carriage must be run back until it is in contact with the rear stops, and secured in that position by suitable skiddings placed between the front of the platform and the front transom of the carriage. The jack must then be pumped up sufficiently to throw the carriage on its rollers, and pumped up from time to time to keep the carriage in that position.

Spare jacks in store must be pumped up in the "Frame, store, hydraulic jack," to keep the requisite pressure on the leathers, special blocks being supplied for use with rear roller jacks.

The latter must be lashed to the "frame" to prevent it falling, in the event of the pressure going off.

### Vavasseur Mountings.—Central Pivot.

### B.L. 8″ Carriage and Slide.

The carriage and slide are similar in general form and arrangement to those for the B.L. 6″ gun.

Each cylinder bracket of the carriage forms a separate casting; these are connected by two vertical transoms and a bottom plate, forming a rectangular well.

The arrangement of the capsquares is similar to that in the 8″ broadside carriage.

A lining of manganese bronze is riveted to the under side of each cylinder bracket.

The arrangement and construction of the hydraulic buffers are similar to those in the 8″ broadside, but there is no hydraulic gear for running in.

The elevating gear is generally similar to that of the 8″ broadside. It consists of the following parts :—

Arc of forged steel, 13 teeth, graduated to 15° elevation and 5° depression, in degrees, with intervals of 10 minutes.
Wheel of cast steel, 24 teeth, 9·55″ diameter.
Shaft for wheel, steel, 2·25″ diameter, 8·71″ total length.
Pinion of cast steel, 12 teeth, 5·75″ diameter.
Worm wheel of cast steel with gunmetal rim, 46 teeth, 18·3″ diameter.
Friction disc clutch for worm wheel, consisting of four discs of gunmetal 6″ diameter; four discs of steel 6″ diameter; one ·375″ thick and three ·25″ thick, one disc of steel 7·5″ diameter, and one steel spring washer.
Shaft for worm-wheel of steel 2·25″ diameter, total length 18·923″.
Worm of forged steel.
Guard for worm wheel of gunmetal.
Sliding worm spindle of steel 1·75″ diameter, 52·46″ total length, with collar and nut.
Wheel for spindle, cast steel, with gunmetal bush, 33 teeth, 15·756″ diameter.
Pinion for wheel, forged steel, 10 teeth, 3·98″ diameter, with a long sleeve bushed with gunmetal.
Shaft for pinion 1·5″ diameter, 14·51″ total length, with one wrought-iron collar and one nut.
Handwheel for shaft of M.C.I. 24″ diameter with handle.
Bracket for pointer of cast-steel with two steel tap-bolts.
Pointer, gun-metal, with steel stud and nut.

The slide.

The slide is supported on four coned rollers over a fixed pivot plate, and is secured by four holding-down clips, one to each roller.

The pivot plate is of the general central pivot type, but the teeth cut on the centre boss are spur, not worm wheel, and are inside the boss. These teeth gear with the teeth of two horizontal pinions, on vertical shafts working in bearings between the sides of the slides. On the upper end of each pinion shaft is a worm wheel, which gears with a worm on a cross horizontal shaft, worked by a handwheel on the outside of each side of the slide, through a train of spur gearing, clamped by an ordinary screw clamp.

The right hand of the two pinions which gear with teeth of the pivot plate is a driving pinion, and the left hand the trailing pinion. There are 11 teeth on the driving pinion but only 10 on the trailing pinion; as the worm wheels and worms are the same for both pinions the driving pinion will always be in advance of the trailing pinion. The worm wheel of the trailing pinion is connected with its shaft by a friction disc clutch.

The parts of the gear are as follows :—

Pinions of cast steel, driving, 11 teeth, 7″ diameter; trailing, 10 teeth, 6·366″ diameter, each with key and tap bolt.
Shafts for pinions of steel, 2·75″ diameter, right hand 19″ long, left hand 22·3″ long.
Worm wheels, gun metal, 18 teeth, 10·026″ diameter.
Friction plates, 6″ diameter, three of steel, three of manganese bronze, and one cover plate of steel, 7″ diameter.
Spring for clutch of steel, spiral, square in section, ·625″. To compress ·47″ with a load of 1,830 lbs. and to stand crushing up close without permanent set.
Worm shaft of steel, 2″ diameter, 62·82″ long, with a wrought-iron nut on each end.
Two worms for shaft, of forged steel.
Two covers for worm brackets, one each side, of sheet brass.
Two wheels for worm shaft, of cast steel, 22 teeth, 8·753″ diameter.
Two training pinions of same dimensions, but formed with long metal bushed sleeve, each with stud of wrought-iron 14·535″ long, 1·75″ diameter.
Two handwheels of M.C.I. 30″ diameter, with handles 15″ long.
Two gunmetal covers, with iron stops for brake handle.
Two brake screws of steel.
,, ,, handles of wrought-iron.

The girder sides of the slide are connected at the centre by a wrought-iron beam, which when the slide is in position is directly over the central boss of the fixed pivot plate. There is a hole in the centre of the beam through which a flanged cap of cast steel projects and takes a bearing on the top of the boss. The under surface of the cap is spherical in form and works on a bearing pivot of manganese bronze placed on the pivot plate. This bearing pivot consists of a disc 9·9″ diameter, curved to a radius of 8·75″, and about ·5′ thick, its thickness being adjusted to suit each mounting.

The flange of the cap rests on the beam; eight vertical studs fixed to the beam pass through holes in the flange; on these, above the flange are placed spiral springs, which can be adjusted by means of nuts, that any desired proportion of the weight of the gun and mounting can be taken on the cap, thus relieving the rollers of the slide.

There is a gunmetal cover for the centre of the cap attached by four gunmetal screws. It consists of a circular disc 9″ diameter and ·15″ thick.

The springs are square in section ·875″, length 3·45″. They ought to compress about ·21″ with a load of 6,000 lbs. Maximum safe load, 14,400 lbs.

The axles of the rollers are eccentric so that they can be adjusted in their bearings as required. In the axles are lubricating channels, closed at the end by a square-headed metal screw plug. In this plug there is also a channel, closed by an ordinary screw.

A folding platform of teak, on joint bracket of wrought-iron is attached to the rear of the slide. A loading crane is fitted to the end of the left side of this platform. It consists of a curved wrought-iron jib, fitted with an eyebolt to take the hook of a tackle at the end, and with a belaying pin at the side.



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A shield is bolted to the front of the slide as usual; thickness front plate 1·25″, top plate ·75″.

A cover plate for the training rack is attached to the slide at the centre underneath. It consists of a flat steel ring 70·3″ external diameter, in four segments, keyed together and to the slide.

The following stores are required with each mounting:—

Filling measure for hydraulic buffer. This is a gallon measure of tin plate, with a metal cock at lower end. It is marked internally to show 1 quart, 2 quarts, and 3 quarts.

Funnel of copper, with metal socket to screw into valve box. This is the same as used with 6″ C.P.

Spanners, hydraulic buffer:—

(1.) Wrought-iron. 9·75″ long, for valve box cap, by-pass valve, and gland of by-pass valve. This is a double ended spanner, having jaws at one end and a square keyway at the other.

(2.) Single ended spanner, with jaws and nibs, slightly bent, 24″ long, for plugs of cylinders.

(3.) Single ended spanner, similar to above but 16·5″ long, for gland of cylinder.

1 eyebolt of wrought-iron, length 4·75″, for withdrawing roller axles.

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